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POPULAR AND PRACTICAL ENTOMOLOGY

NOTES ON THE MIGRATION OF MELANOPLUS ATLANIS RILEY IN NORTHERN NORTH DAKOTA IN 1920.

OBSERVATIONS IN *BOTTINEAU AND RENVILLE COUNTIES.

BY C. L. CORKINS, B.S.

Fort Collins, Colo.

Introduction.

During the summer of 1920, an intensive, as well as extensive, grasshopper campaign was carried on in all of the twenty-four townships of Renville County, North Dakota. Altogether, over 400 tons of bran were mixed into poison mash and systematically spread. This work was carried on according to the Grasshopper Law of 1918 of North Dakota and ample supervision was provided. Each township had either one or two grasshopper supervisors in charge of the mixing and distribution of the mash while the writer was in charge of all operations. Likewise Canada, immediately to the north of Renville County, waged a well organized campaign against the 'hoppers. Some other counties in North Dakota, because of lack of funds, were unable to meet the emergency. The following data will show what an unexpected, extensive migration from these did to upset the work where grasshopper control was effected.

The species concerned has been identified as the Lesser Migratory Locust, *Melanoplus atlanis* Riley. Its habits of flight, as observed in this migration, were very unlike those of *M. atlanis*. They could better be attributed to the presumably extinct Rocky Mountain migratory locust, *Melanoplus spretus* Uhl.

Migratory Habits.

The migratory habits of *M. atlanis* have previously been thought to be as follows:

1. Flight caused by food becoming tough and unpalatable, or the lack of any food at all.
2. Flight may be either crosswise to, or with the prevailing wind.
3. Flight is low, usually within a few feet of the ground.

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* The observations in Bottineau County were made by Mr. A. C. Burrill, at that time Special Field Agent of the Bureau of Entomology, U.S. Dep. Agr. The writer is greatly indebted to Mr. Burrill for his co-operation in obtaining corroborative data and other courtesies.

4. Flight is not extensive. 'Hoppers fly from field to field or may migrate a few miles.

The first migration noted at Mohall, N.D., was on July 9th, within ten days after the first adults appeared. It was observed, both in Renville and Bottineau Counties, that the 'hoppers would rise up out of such green crops as wheat and barley which were yet succulent, and fly off. This occurred repeatedly during the season. Often times a swarm would settle down in a wheat field one afternoon and leave the next day, even though the food at hand was abundant and palatable. In this manner, a field of excellent wheat near Mohall was infested and abandoned four times with but slight damage done.

The 'hoppers would take off for flight in a stiff breeze. Through the hot part of the day, the wind would often alternate between calms and stiff breezes. During the calms, no 'hoppers could be seen coming out of a field. When the wind would come up and wave the grain, a buzzing could be heard as they swarmed out. They would mill for a short time, then, when an altitude of 15 to 30 feet was gained, take off with the wind. As is shown in the tabulated chart, the direction of flight was always with the wind, though milling would occur during calms.

Until August 12th, the height of flight was estimated with the aid of a yellow glass which enabled the observer to look directly against the sun. The thickest portion of the swarm appeared to be 500 feet above ground. On August 12th, data on the altitude of flight was taken by the writer in an airplane. The swarm was found to be densest at 500 to 800 feet. A few scattering individuals were found when the altometer registered 1650 feet above ground.

That the migrations were extensive, is shown by our data often taken 50 miles apart. No definite information as to the distance each individual would fly can be given. Yet, we determined the speed of flight of individuals near the ground by means of an automobile, to be 20 miles per hour. Just how long each individual was in the air cannot be stated. Flight normally begins at 11.00 A.M. and lasted until 4.00 P.M. This information, together with the data on the altitude of flight and the known fact that 'hoppers alighting in a field one afternoon would fly on the next day, seems to indicate that many miles were covered.

The Bearing on Control Measures.

In the case of this species, the length of flight coupled with the fact that 'hoppers often leave succulent fields, has an important bearing on control measures. It means that when the residents of some one territory have been delinquent in control measures, and those of some other territory have waged a successful campaign, the parties of the first instance may cause the reinfestation of the fields of the parties of the second instance and upset some of their good work. Also farmers in infested areas do not well understand the outcome of such an extensive migration and either grasp at the hope that all their 'hoppers will leave or believe that poisoning is useless. Thus a control campaign may be demoralized at just the time operations should be continued with intensity.

Observations on Flight and Relation of Weather Conditions to Such.

Date—July, 1920	Time of Observation	Direction Wind Blew Towards	Direction Migration Went Towards	Wind	Weather Conditions Temperature Rain	Height of Flight includes all altitudes below that noted	Remarks	Location of Observer
9	2PM	NW	NW	Very Slight	Hot & Clear	500 ft.	Milling some, due to air being quiet at times.	M.
9	3½PM	NNW	NNW	ditto	ditto	300 ft.	ditto.	A.
10	1PM	NNW	NNW	Very Slight	"	200 ft.	"	B.
12	3½PM	NNW	NNW	Slight	Cool & Cloudy	200 ft.	Slight, local migration.	B.
14	3PM	S	S	Strong	Clear	500 ft.	Slight migration.	W.
14	3PM	E	E	Slight	"	50-200 ft.	Hugh swarms making sun grey. Lower swarms going crosswise to upper.	A.
15	12M	N	N	Stiff	Hot & Clear	1000 ft.	Huge swarms.	M.
15	12M	NE& NW	NE& NW	Stiff & Calms	"	Low	Observed in Auto trip all the way, Bottineau to Mohall.	
16	—	—	—	—	Cool & Cloudy	—	No migration.	M.
17	1PM	SE	SE	Stiff	Hot & Clear	50-500 ft.	Swarms scant lasting several hours.	M.
17	1-2PM	SSE	SSE	Mod'ate	"	400 ft.	Inch wide slot 12" from face gave estimation of 100 per sec.	B.
18	2PM	NW	NW	Slight	"	50-500 ft.	All swarms very high lasting several hours.	M.
19					Cool & Cloudy		No migration.	M.
19	1PM	N	N	Slight	Cool & Clear	200 ft.	Very heavy flight.	B.
20	11AM	WNW	WNW	Stiff	Hot & Clear	500 ft.	Light swarms.	M.
20	2PM	WNW	WNW	Stiff	"	500 ft.	Huge swarms abating 2.30 P.M.	M.
21	1PM	NW	NW	Strong	Sultry & dry	500 ft.	Largest swarms to date going over until 4.30 P.M.	M.
22					Rainy Cloudy		No migration.	M.
23					"		"	M.
24					"		"	M.
25	10AM 2PM	NW	NW	Strong	Hot & Clear	500 ft.	Slight flight locally in the afternoon.	M.
26	2PM	ESE	ESE	"	"	500 ft.	Large swarms at rate of speed estimated 20mi. hr.	M.
26	3PM	E	E	"	"	500 ft.	Slight swarms.	Mb.
27	12M	NNE	NNE	Slight			Only small swarms.	M.
27	12M	NE	NE	"	Cool	300 ft.	ditto.	L.
28	1PM	SSE	SSE	Strong	Hot & Clear	500 ft.	Fair sized swarms.	M.
28	12M	S	S	"	"	500 ft.	ditto.	B.
29	1PM	SE	SE	"	"	500 ft.	"	M.
29	12-3	SE	NW	Very Slight	"	100 ft.	First time hoppers have gone against the wind.	A.
30				Cool & Cloudy			No migration.	M.

Date—July, 1926	Time of Observation	Direction Wind Blew Towards	Direction Migration Went Toward	Wind	Weather Conditions Temperature Rain	Height of Flight Includes all altitudes below that noted	Remarks	Location of Observer
30	1PM	N&NW	N&NW	Slight	Hot & Clear	200 ft.	A few going desultorily 10 mi. south of Antler.	A.
31	1PM	NW	NW	Very Slight	"	2000 ft.	Largest swarm yet observed, hazing the sun. Milling during calms and drifting Northward.	M.
31	1PM	?	NW	"	"	200 ft.	Few flying.	B.
Aug. 1	1PM	NW	NW	Stiff	"	500 ft.	Only scattered individuals	M.
1	2PM	N&NW	N&NW	"	"	300 ft.	Lower hoppers milling.	B.
2	2PM	NNE	NNE	"	"	500 ft.	Small flight all at high altitudes.	M.
3	12-2PM				Rain		Rain at 11A.M. No flight.	M.
4	1PM	SSW	SSW	Very Slight	Hot & Clear	2000 ft.	Huge swarms drifting slowly and milling dur-calms.	M.
5					Rain		No flight.	M.
6					Cloudy		No flight.	M.
7	11AM	NE	NE	Slight	Warm & Clear	500 ft.	Small flight.	M.
8	12M	E	E	Strong	Warm & Clear	300 ft.	Fair sized swarms.	M.
9	1.30PM	NE	NE	Stiff	Hot & Clear	500 ft.	Fair sized swarms.	M.
10	11AM	"	"	"	"	500 ft.	Fair sized swarms.	M.
11	11AM	SE	SE	Slight	"	1000 ft.	Large swarms.	M.
12	10AM-3PM	SE	SE	"	"	2000 ft.	Large swarms lasting all day.	M.

NOTE: Abbreviations are as follows: Antler—A; Bottineau—B; Lansford—L; Mohall—M; Maxbass—Mb; and Westhope—W. The altitude observations are only approximate.

AUSTRALIAN SARCOPHAGIDAE; NEW SPECIES AND DATA CONCERNING OTHERS[1] (DIPTERA).

BY R. R. PARKER,

Bozeman, Mont.

This paper is the first of several which the writer expects to prepare describing new species of Sarcophagidae from Australia and presenting data concerning other species found on that continent. That early writers have described some of the species concerned is very probable but since it is impossible to recognize their species and the types are inaccessible, the only course open is to neglect them, leaving to the future questions of priority. In this peculiar group of insects this course seems fully justified.

1. Contribution from the entomological laboratory of the Montana State College, Bozeman, Mont.

Sarcophaga queenslandae, n. sp.

Holotype, ♂ : collection of R. R. Parker.

Allotype, ♀ : collection of R. R. Parker.

Male.—Length 12 to 13 mm.; one row of black cilia behind eyes; cheek vestiture white; gena with a few small black hairs above transverse impression and dorsal to these some minute golden hairs; bristles bordering lateral mouth margin not extending backward along lower edge of cheek; vestiture of sides of thorax mostly white (includes lower portion of mesopleura); spiracular hairs light colored; anterior and middle coxae with some white hairs, short and inconspicuous on third; hind tibia with posterior beard only; ventral surface of first three abdominal tergites and first four ventral plates (except posterior margin of fourth and sometimes of third) with white hair; viewed from rear each forceps prong shows a small group of short, close-set bristles just anterior to forward bend.

Head.— Viewed from front parafrontals, genae and anterior portions of cheek vary from grayish with light golden tinge to light gold. Breadth of front at narrowest part less than half eye width; cheek height greater than one-third that of eye. Front prominent; at its narrowest part frontal vitta about same width as each parafrontal, its sides not parallel. Third antennal segment more than twice that of second. One row of black cilia behind eyes. Cheek vestiture white. Gena with a few small black hairs near eye orbit above transverse impression and dorsal to these some minute golden hairs. Palpi dark.

Chaetotaxy.—Lateral verticals absent; vibrissae inserted very slightly above line of oral margin; each row of twelve or thirteen frontals extending below base of vitta, lower portion divergent; bristles bordering lateral mouth margin not extending back beyond transverse impression.

Thorax.—Mesonotum clothed with medium long, reclinate, bristle-like hairs. Vestiture of side of thorax largely of white hair; scutellar bridge with white hairs. Spiracular hairs light.

Wings.—Third vein with bristles; costal spine vestigial; section III of costa longer than section V; alulae fringed with dark hair. Epaulets black.

Legs.—Anterior and middle coxae with some white hair, short and inconspicuous on third. Posterior coxa with prominent "brush": anterior face of femur with three rows of bristles; tibia with posterior beard only. Anterior and posterior ventral rows of bristles of middle femur present, former of short bristles and complete, latter present on about distal third; anterior face of tibia with a single bristle; submesotibial bristle vestigial.

Chaetotaxy.—Anterior dorsocentrals (one or more) but little differentiated from vestiture of praescutum; acrostichals and inner presuturals absent; only last two pair of posterior dorsocentrals at all well developed, anterior to these two or more very weak pairs; prescutellar acrostichals absent; scutellar apicals present; three sternopleurals; lower stenopleura with bristles and white hair.

Abdomen.—Clothed with short reclinate bristles, beneath with white hair except ventral surface of fourth tergite (which bears much longer black hairs) and posterior margin of fourth ventral plate (sometimes of third also); ventral plates quite distinctly rectangular.

Chaetotaxy.—Third segment with two dorsal marginals and usually with two or three pairs of laterals.

Genital Segments (figs. 1, 2).—Basal portion of fifth ventral plate keeled, lamellae long and narrow with very long fine hairs on distal portion. First segment; about twice length of second, gray pollinose, ground color brownish or blackish, vestiture partly longer and much coarser than that of first. Forceps; at about three-fourths way to tip bent forward, then narrowing rapidly to tip which ends in a very small tooth, basal portion clothed with a very long, fine hair tending to be tufted, posterior surface clothed with hairs nearly to bend (see profile view), viewed from behind prongs approximately nearly to bend and just beyond bend each with a small group of short, close set bristles.

Genitalia.—(See figure.) Anterior clasper very broad basally narrowing to bluntly rounded tip.

Female.—Differs from male in following essential characters: breadth of front at its narrowest part about three-fourths eye width; frontal vitta at its narrowest point not as wide as each parafrontal; black hairs on gena fewer (usually one or two) or absent: mesonotum clothed with very short reclinate bristles; abdominal nota clothed with short reclinate bristles throughout except that part of ventral portion of first notum; first ventral plate has white hairs; dorsal marginal, usually short and decumbent, occasionally absent: sixth ventral plate orange brown, bipartite, with shallow lobes posteriorly; fifth notum same color as preceding nota, edge fringed with bristles, opening triangular (posterior edge of sixth ventral plate as base).

Described from six male and eight female specimens.

Range.—AUSTRALIA; *North Queensland*;—Gordonvale, Cairus, 1917 (J. W. Illingworth); Townsville, (F. H. Taylor, H. Priestley);—*North Territory;* (G. F. Hill).

The holotype and allotype are from the Gordonvale material.

The Gordonvale specimens were reared from carrion by Dr. J. F. Illingworth.

In general appearance this species resembles *S. illingworthi,* n. sp., but both sexes are easily distinguished by the absence of prescutellar acrostichals and the presence of white hair on the mesopleura and first coxae. In females of *S. illingworthi* the fifth notum (first genital) is puckered dorsally, while in *S. queenslandae* it is not. *S. frogatti* Taylor is separated from this species by its smaller size, character of vestiture of ventral plates, and genital characters in the male. In the female the character of the fifth notum is distinctive. The female of *S. frogatti* has white hairs behind the mesopleural bristles.

Sarcophaga illingworthi, n. sp.

Holotype, ♂; collection of R. R. Parker.

Allotype, ♀; collection of R. R. Parker.

This species is so similar to *S. queenslandae* that it seems unnecessary to give more than a summary of the essential characters.

Male.—Length, 11-15 mm. Usually ten to twelve pairs frontal bristles: side of thorax with considerable white hair but mesopleura clothed with black hair; white hairs on scutellar bridge; spiracular hairs dark; middle coxa with

some white hairs dorsally, few and inconspicuous on first and third; posterior coxa with "brush"; posterior tibia with posterior beard, anterior beard much weaker but present; praesutural acrostichals weakly differentiated, the prescutellar pair present; ventral surface of first and second, and sometimes of third abdominal notum, and the first three ventral plates (sometimes only anterior portion of first) except for marginal hairs, clothed with white hairs: base of fifth ventral plate (fig. 5.) with keel, lamellae narrow, distally with medium long hair, proximally each with a small angular "flap" margined with bristles: forceps basally with very long hair (not tufted); basal portion of prongs joined by the light colored connecting chitinized (?) band, prongs long and gently curved forward, approximated to near tips, latter somewhat divergent, viewed from behind each prong just behind tip with a short lateral row of short bristles and above these a fringe of long hairs resembling a beard: genitalia specific (see figs. 3 and 5).

Female.—Essential characters similar except as follows:—white hairs on abdomen confined to the first ventral plate and ventral surface of first notum: fifth notum (first genital) same color as those preceding, puckered and with slight emargination dorsally, ventrally overlapping ventral plates.

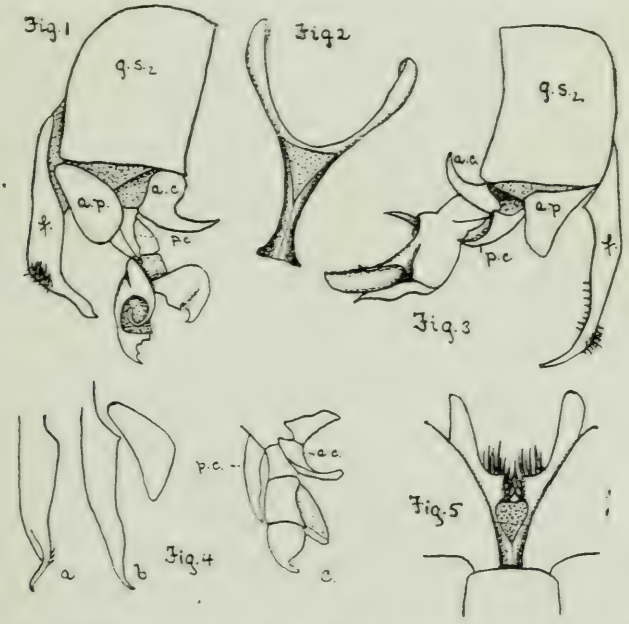

Fig. 1. *Sarcophaga queenslandae*, n. sp., profile view of genital segments. Fig. 2. Same, fifth ventral plate. Fig. 3. *S. illingworthi*, n. sp., profile view of genital segments. Fig. 4. *S. froggatti* Taylor;—a, posterior view of a forceps prong; b, profile view of a forceps prong showing accessory plate; c, penis and claspers. Fig. 5. *S. illingworthi*, fifth ventral plate.
g.s.$_2$, Second genital segment. a.c., Anterior clasper. p.c., Posterior clasper. a.p., Accessory plate. f., Forceps.

Described from four male and four female specimens.

Range.—AUSTRALIA: *North Queensland;* Gordonvale, 1917 (J. F. Illingworth), Townsville (F. H. Taylor); *North Territory;* Darwin (G. F. Hill).

The holotype is from Gordonvale, and the allotype from Townsville, North Queensland.

See discussion following *S. queenslandae* for remarks on separation from *S. illingworthi* and that following *S. froggatti* for separation from that species.

Sarcophaga froggatti Taylor.

1917. *Sarcophaga froggatti* Taylor, Bull. Ent. Res., vol. 7, pt. 3, Jan., p. 265. Original description and notes on habits.

Types.—Collection of Australian Institute of Tropical Medicine, Townsville, North Queensland, Australia.

Male.—Length, 7 to 11 mm. Viewed from front parafrontals, genae and anterior portions of cheeks light golden pollinose; one row of black cilia behind eyes; cheek vestiture white; gena with minute golden or whitish hairs near eye orbit, sometimes a few black hairs near transverse impression; bristles below vibrissae not extending backward along lower cheek border (perhaps inconstant): side of thorax with considerable white hair, that on mesopleura only on lower anterior portion; anterior and middle coxae with some white hairs, small and indistinct on third coxa; posterior tibia not bearded; leg vestiture short: anterior dorsocentrals present but weak; presutural pair of acrostichals weakly developed; at least four pairs dorsocentrals, only last two at all strong; prescutellar acrostichals, absent or if present very weak; ventral surfaces of first three abdominal nota with white hair: posterior half of fourth and posterior margin of third ventral plate with black hair, other first four plates with white hair: fifth ventral plate without bristles; genital segments brownish, first sometimes grayish pollinose: seen from rear forceps prongs approximately about two-thirds length, then narrowing and divergent, bending slightly forward, then the slender ends convergent but not meeting, and the tips again turned outward; on outer side at convergent bend each prong with a very few short bristles (not easily seen, see fig. 4a): genitalia specific (fig. 4c).

Female.— Essential characters similar except as follows:—white hairs on mesopleura present on lower half and posterior to mesopleura bristles; vestiture of abdominal nota of short black decumbent bristles throughout, except for white hairs on ventral surfaces of first notum and a few on second; first ventral plate with white hairs, a few anteriorly on second; fifth notum (first genital) same color as those preceding, puckered and slightly emarginate dorsally.

Range.—AUSTRALIA; *Queensland;*—Winton (E. V. Hines) (cited by Taylor), Roma, (F. H. Taylor); *North Territory;*—Darwin, Aug. 2, 1913 (G. F. Hill). One specimen of uncertain locality, record by W. W. Froggatt.

Taylor, 1917, records the maggots of this species attacking sheep. The specimen taken by Froggatt bears the following label, "Horse, Black Tank, Bred Feb. 21, 1914, W.W.F."

The female is very close to that of *S. illingworthi*, but is smaller and lacks prescutellar acrostichals. The first genital notum is practically alike in both species. *S. illingworthi* lacks white hair on the mesopleura while it is present in *S. froggatti.*

For separation from *S. queenslandae* see discussion following that species.

In the female a few bristles are sometimes found bordering the cheek along the lateral mouth margin. In the male the lack of the bristles was constant in all specimens examined.

This species has been identified by me from a single female paratype sent me by F. H. Taylor. This specimen was a reared form and undersized but I feel reasonably confident that the species here concerned is *S. froggatti*.

SOME NEW AND RARE COLEOPTERA FROM SOUTHWESTERN FLORIDA.

BY W. S. BLATCHLEY,
Indianapolis, Ind.

I reached Dunedin,[1] Florida, where I have my winter home, on November 18, 1920, and, with the exception of three weeks, collected about there until April 18, 1921. During the nine winters I have been in Dunedin I have taken the great majority of beetles which can be found in that vicinity at that season, yet each winter I manage to secure a number of interesting forms.

On March 1 I started on a three weeks' trip to the most southern available points on the west coast. My first stop was at Lakeland, a junction point on the A.C.L. railway, where I spent two days. I had collected about there on two previous occasions at the same season and therefore took little of especial interest. A number of the large tortoise beetle, *Chelymorpha geniculata* Boh., were beaten from bunches of Spanish moss in which they were hibernating. The usual food plant of this species is the creeping goat's-foot morning glory, *Ipomoea pes-caprae* Sweet, but as that plant grows only along the sea-shore, the bettle evidently uses an allied one for food in the interior, Lakeland being 30 miles from the coast. Another capture was a fine specimen of the handsome Cerambycid, *Ancylocera bicolor* Oliv., which was swept from an oak shrub.

At Lakeland I was joined by J. H. Williamson of Bluffton, Ind., who was collecting dragonflies, and on March 3rd we took the train for Ft. Myers, the most southern railway station on or near the west coast. Ft. Myers has a population of about 10,000 and is located on the Caloosahatchie River, 14 miles from the Gulf Coast. The river is a tide water stream to above the town, the black mangrove and other maritime shrubs lining its banks in the uncleared areas. The winter had been very dry and the first day and a half's collection yielded little but what I had taken on previous visits at the same season. However on the third morning I began sifting about an extinct or wet-weather pond which, during the rainy season, covers shallowly an area of 15 to 20 acres, south of the railway and just outside of the city limits. With the exception of one or two small pools which were full of dead or dying fish the pond was wholly dry, and its mucky bed filled with the decaying stems of pickerel weed. *Pontededia cordata* L., and several species of arrow-head, *Sagittaria*, smart weed, *Polygonum*, and other semi-aquatic vegetation. For several hours I sifted with good success the debris from about the roots of these plants in the dryer portions of the old pond area. Happening to pull up some of the Pontederia roots from a damp mucky place near one of the pools I noted several species of water beetles in the muck. That

[1]See Can. Ent., xlix, 1917, 137.

afternoon I returned with a trowel and a soap box, and using the latter as a seat, as near the edge of the pools as I could get without miring down, I began pulling and digging up the decaying pickerel weed roots and stems and shaking them over a newspaper spread out on a thin board which I held on my knees. I soon found I had struck "pay dirt," as aquatic and semi-aquatic beetles by scores were unearthed. I worked thus about this pond for the greater part of three days, sifting at intervals but digging in the muck most of the time, and secured 109 species of beetles besides a number of subaquatic Hemiptera and Orthoptera. A number of the beetles are mentioned on the pages which follow. Others of special interest were *Tachys albipes* Lec., *Chlaenius perplexus* Dej., *Colpius inflatus* Lec., *Bidessus subsericeus* Bl., *Laccophilus gentilis* Lec., *Celina angustata* Aubé, *Cercyon variegatum* Shp., *Oosternum costatum* Shp., etc. Among the Rhynchophora taken, which will be treated elsewhere, were *Smicronyx quadrifer* Casey, not before known from Florida, and a new species of *Hyperodes*. The three most abundant beetles about the pond were *Tachistodes* (*Agonoderus*) *testaceus* (Dej.) taken mostly by sifting, *Hydrovatus compressus* Shp. from the muck, and *Disonycha pennsylvanica conjugata* (Fab.), which occurred by hundreds on *Polygonum*.

On the afternoon of March 8 we started with the mail carrier in a Ford machine for Caxambus, a fishing station on Marco Island, 90 miles distant. We were due there at 7 P.M. but after various mishaps and the enforced use of three different flivvers, we arrived at 11.30. Here, on account of the dry season and consequent lack of fresh water on the island, the collecting was poor. Mosquitoes, a brackish or salt-water species, and therefore not disheartened by the drouth, were present in hordes. Two days were spent in taking what we could find and early in the morning of the third day my companion, discouraged by the drought and the mosquitoes, started back overland to Ft. Myers, while I took passage in the "mail boat," an 18-foot open gasoline launch, for Chokoloskee, my original objective, 35 miles farther south, where I arrived at noon on March 11.

Chokoloskee, a fishing village on a key or island of the same name—one of the "Ten Thousand Islands" off the southwest coast of Florida—is the most southern postoffice and settlement on the west coast. Most of the neighboring islands are covered with mangrove and overflow at high tide. Chokoloskee was originally somewhat higher and was therefore used by the Seminole Indians and their predecessors as a village site. It must have been so used for centuries, as almost the entire area of 107 acres is covered with shell heaps, "kitchen-middens," to a thickness of three to eight feet, and in one place is a look-out mound, a fourth of an acre in area and 27 feet in height, of the same materials. There is no stream and only one or two small brackish water ponds on the island. Rain or cistern water is used exclusively by the inhabitants. The vegetation is sparse, the shrubs and trees for the most part stunted, though fairly abundant in species and number. I spent five days on the island, and one day at Everglade, another settlement five miles to the northeast. My collecting was done mostly by beating into an umbrella and by sweeping, and except in Rhynchophora, the results were poor. The fauna is very nearly the same as at Cape Sable and Key West, not more than 20 species being found which had not been

taken by me at those stations. In the rainy season, May to August, there is probably good collecting to be had here, at least I was so told by my landlady, Mrs. C. G. McKinney, who for years has collected butterflies and Orthoptera for northern supply houses. At that season, however, mosquitoes are at their best, and they were bad enough for me in March.

I left Chokoloskee for Ft. Myers on March 18, by a little freight steamer which plies between the two ports. Had one afternoon's collecting at Marco, where we passed the night, and part of the next one at the extinct pond at Ft. Myers. It was on this last afternoon at the pond that I took the second known specimen of my *Pachydrus princeps*. I did not recognize it at the time, else I might have been there yet, searching for others. The next morning I took the train for Tampa and from there to Dunedin by automobile bus, arriving at 4 P.M.

Dicaelus quadratus Lec.[2]—A single female, 25 mm. in length was taken March 6 beneath an old boat on the margin of the extinct pond at Ft. Myers. It is the same as a species from St. Petersburgh, identified for me by Frederic Blanchard as *D. carinatus* Dej. and recorded by me under that name.[3] I did not at that time have a copy of LeConte's description of *quadratus* available, but with it now in hand there is no doubt that the two specimens are his species, which he states is .96 of an inch in length. Horn, in his synoptical table,[4] separates *quadratus* from *carinatus* only by the humeral carina being "moderately elevated and acute near the base only" in *quadratus* and "very long and more elevated, acute in the entire length" for *carinatus*. In his bibliography he gives the length of *quadratus* as 25 mm., and of *carinatus* as 20 mm. The question arises, may not these two nominal species represent the different sexes of one? If so, it would have to bear Dejean's name.

Dicaelus subtropicus Casey.—The types of this species[5] were from Palm Beach, Fla. A single specimen was taken on February 9 beneath a chunk on Hog Island, opposite Dunedin.

The species of *Badister* with unspotted elytra form a difficult group to separate satisfactorily with words. The original descriptions of Leconte are conflicting in a number of instances with his later keys[6] and as a consequence the species are badly confused in most collections. Three species of this group have been taken by me in Florida, one of which appears to be undescribed.

Badister flavipes Lec.—One specimen March 18 from the extinct pond at Ft. Myers. In the original description the intervals are said to be convex, whereas in the keys of LeConte it is included under division with intervals flat. In the specimens at hand, from Little River and Ft. Myers, the three innermost intervals are subconvex, the outer ones flat.

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[2]In the notes and descriptions which follow, the sequence and nomenclature is that of Leng's new "Catalogue of the Coleoptera of America north of Mexico." Where the generic name used by him is different from that heretofore in common use the old name in parenthesis follows the new, e. g. *Pseudamphasia* (*Anisodactylus*) *sericea* Harris.

[3]Can. Ent., xlvi, 1914, 63.

[4]Bull. Brook. Ent. Soc., iii, 1880, 51.

[5]Memoirs iv, 1913, 151.

[6]Trans. Amer. Ent. Soc., viii, 1880, 165; Bu'l. Brook. Ent. Soc., v, 1882, 7.

Badister seclusus sp. nov.

Elongate-oval. Black, shining, the elytra and under surface strongly iridescent; narrow margins of thorax and elytra brownish-piceous; antennae piceous, the two basal joints paler; palpi and legs dull brownish-yellow, head as wide as base of thorax, finely alutaceous, impunctate, its front portion distinctly declivent and concave with prominent raised margins; eyes very large and prominent; antennae nearly half as long as body, the third joint more than twice as long as second, slightly shorter than fourth, joints 4 to 11 very slender, more than four times as long as broad. Thorax short, widest at apical third, the sides thence oblique and distinctly converging to base, which is but two-thirds as wide as apex; side margins narrow to behind the middle, then gradually widening and reflexed to base; hind angles obtuse, not rounded; median line deep, entire; basal impressions narrow, deep. Elytra at base one-third wider than base of thorax; humeri broadly rounded, sides straight and parallel from basal fourth to apical fifth, then broadly rounded into the obtuse apex; striae deep, intervals subconvex, the second with two large dorsal punctures on its inner margin, the first at middle, the other at apical fourth. Length 4.8 mm.

Dunedin, Fla., March 10—April 19. Two specimens taken by sweeping ferns in a dense damp hammock. Evidently allied to *flavicornis* Casey, described[7] from Iowa but much smaller and with dark antennae. The basal side margins of thorax are much more strongly widened and reflexed than in *reflexus*, the hind angles more distinct. It is possible that this is the species listed as *B. micans* Lec. by Schwarz, and by Leng, but it is a much smaller species with very different form of thorax from what I have as *micans* from Indiana, which was compared with LeConte's labelled type. As pointed out by Casey, loc. cit., the original description of *micans* calls for a species 4½ lines (9 mm.).

Badister reflexus Lec.—Four specimens from the pond at Ft. Myers; one from Tallahasse. Leng records it[8] only from Suwanee. The Florida specimens agree with those from Indiana in having the hind angles "very obtuse and rounded," as stated by LeConte in his original description, whereas in his key they are mentioned as "obtuse, not rounded."

Pseudamphasia (*Anisodactylus*) *sericea* (Harris)—This common northern Carabid has not heretofore been reported from Florida, though it is known from Louisiana. Two specimens were taken from beneath debris on the shore of Lake Okeechobee near Moore Haven on March 2, 1918. Casey[9] has recently erected for it the genus *Pseudamphasia*.

Pronoterus semipunctatus (Lec.)—From the muck about the Pontederia roots in the pond at Ft. Myers I took three specimens of a small Dytiscid which I was unable to identify, even as to genus, with the literature available. Thinking that it perhaps might be a West Indian form, I sent a specimen to A. J. Mutchler of the American Museum of Natural History. He replied that it was not represented in the Museum collection either from the United States or West Indies, and suggested that I refer it to H. C. Fall, who has been making a recent

[7]Memoirs, ix, 1920, 208.
[8]Bull. Amer. Mus. Nat. Hist., xxxiv, 1915, 581.
[9]Memoirs v, 1914, 195.

study of the smaller Dytiscidae. This I did, and Mr. Fall reported that: "It seems almost surely to be the rare *Canthydrus semipunctatus* (Lec.) described from Michigan[10]. It is also probably *Pronoterus punctipennis* Sharp, described from Brazil! On comparing your specimen with LeConte's unique type in the Cambridge Museum I find that it differs only in being a little smaller, with somewhat darker elytra and with the posterior angles of the hind coxae a little more blunt. I cannot feel so sure that Sharp's species is the same, but the short description is perfectly characteristic so far as it goes. It is not a *Canthydrus*, but must be referred to Sharp's genus *Pronoterus* and, LeConte's name being the older, must be known as *Pronoterus semipunctatus* (Lec.). I do not know that LeConte's specimen has ever been duplicated in this country, so your find is one of great interest. Truly a remarkable distribution if the Michigan, Florida and Brazilian specimens are all one thing!"

Pachydrus (*Coelambus*) *princeps* (Blatch.)—The second known specimen was taken March 19 from amidst the decaying stems of pickerel weed in the extinct pond at Ft. Myers. The unique type was from the east shore of Lake Okeechobee. It was described[11] as a *Coelambus*, but Fall states[12] that it belongs to *Pachydrus*, a tropical genus, hitherto unrepresented in this country.

Celina slossoni Mutch.—One specimen, April 1, from a mass of water weeds in a small pond near Dunedin, known heretofore only from Sanford, Enterprise and Lake Worth, on or near the east coast.

Derallus altus (Lec.)—Three specimens were taken from the debris of the extinct pond at Fort Myers. The only other Florida record is that of mine from Dunedin[13].

Helobata (*Helopeltis*) *larvalis* (Horn.)—Two specimens were secured from the under side of the decaying leaves of pickerel weed at the Ft. Myers pond. They clung to their cover much as did a small mollusk of the genus *Ancylus* which was frequent on the leaves. While the beetle has been taken at several stations in Florida, the only definite one hitherto recorded is Sarasota, where I found a single individual in 1911.

Bacanius subdepressus sp. nov.

Broadly oval, subdepressed. Black, shining; femora piceous, antennae, tibiae and tarsi dark reddish brown; the globular antennal club much paler. Head two-thirds as wide as thorax, minutely and sparsely punctate. Thorax twice as wide as long, sides feebly curved, strongly margined, this margin continuous and uninterrupted to tips of elytra; disk, finely, evenly and rather sparsely punctate, base with a single transverse row of smaller punctures. Elytra as wide at base as, and about two-thirds longer than, thorax, without marginal carinæ or discal striae; sparsely, rather coarsely punctate, the punctures on basal half in part aciculate or substrigose. Pygidium, very minutely punctate. Prosternal process broad, one-half longer than wide, striate each side, minutely punctate, truncate at tip. Metasternum very broad, both it and abdomen very minutely and sparsely punctate. Length .8—1 mm.

[10]Proc. Amer. Phil. Soc., xvii, 1878, 595.
[11]Can. Ent., xlvi, 1914, 64.
[12]The N. Amer. species of *Coelambus*, 1919, p. 1.
[13]Bull. Amer. Mus. Nat. Hist. xli, 320.

Frequent and gregarious, November to April, about Dunedin, beneath the bark of dead water oak and dead white bay; also taken beneath cow dung and by sifting in damp mucky places. Much less convex than any of our other described species.

(To be Continued.)

NEW SPECIES OF CANADIAN SYRPHIDAE, (DIPTERA) Pt. II.

BY C. HOWARD CURRAN,
Orillia, Ont.

Cynorhina robusta, new species

Thorax and scutellum moderately long, pale yellow pilose; abdomen black pilose except the immediate basal corners which bear yellow pile; head brown and black pilose; face chiefly piceous, but yellow above.

Length 11 mm. ♀. Face piceous, immediately below the antennae, more so at the sides, yellow, the cheeks black; face thinly silvery pollinose, the side margins sparsely whitish pilose; in profile the sub-keel-shaped face is slightly produced below the middle indicating a long tubercle. Antennae black, third joint circular and reddish brown in color, the base below reddish; arista black. Front shining black, somewhat narrowed above; antennal process narrowly reddish apically. Pile of the front black; under the eyes yellowish, on the lower half of the occiput brown, black on the upper half, moderately long below. Posterior orbits narrowly grayish white pollinose.

Thorax shining deep blue-black; mesopleurae margined with reddish except below. Dorsum brassy, and clothed with rather long pale yellow pile; pleurae bare except on the meso and sternopleurae; scutellum similar in color and pile to dorsum.

Abdomen wholly shining black, with a strong purplish reflection, wholly short black pilose except the basal angles which bear longer yellowish pile. First two ventral segments yellow apically at the sides.

Legs blackish, short black pilose, longer on the femora; femora tipped with yellow; bases and ends of the tibiae yellow or yellowish; first three joints of the anterior four and second and third of the hind tarsi, yellow.

Wings moderately brownish, less so outwardly, their bases very conspicuously yellow; stigma brownish, but not readily discerned. Squamae whitish yellow, with similar colored fringe. Halteres yellow.

Holotype, ♀, British Columbia, in the Canadian National Collection, Ottawa.

A robust, conspicuous species resembling *Criorhina,* best characterized by the color of the face and the pile, which is longer and denser than usual.

Cynorhinella, new genus

Face considerably produced downwards, tuberculate; side margins distinct; eyes contiguous; antennae short, third joint roundish; thorax longer than broad, without bristles; abdomen slender, twice as long as the thorax, tapering in the male; femora all somewhat swollen, the hind ones considerably so and arcuate, at the end below with an angular projection exteriorly, as in

Tropidea, a smaller one anteriorly; hind tibiae a little arcuate, not ending in a spur. Wings as in *Cynorhina.*

Genotype, C. canadensis, new species.

I am unable to place the following specimen in any genus known to me, and it traces out to *Cynorhina* in Williston's manual, and apparently comes closest to this genus but the thickened, arcuate hind femora with the projection apically, and the more distinct facial side margins separate it. It is related to *Chilosia* and *Chrysochlamys* by the last mentioned character, but there is no semblance of bristles and the shape of the abdomen is distinctive. Superficially it moderately resembles a *Brachypalpus* but the facial shape and tubercle at once preclude it from that genus.

Cynorhinella canadensis, new species

Length 10 mm. *Male.* Face chestnut brown, concave below the antennae with a prominent rounded tubercle about the middle, below which it is slightly produced to the not prominent oral margin; side margins well defined, as in *Chilosia,* the facial slopes with fine whitish pollen, the side margins with sparse whitish pile; cheeks and frontal triangle shining, concolorous with the face; vertical triangle brown, the sides of the triangle about equal, with brown pile; occiput shining chestnut, with whitish pile below and brownish above. Thorax shining blueblack, the dorsum with yellow pile, which is intermixed with black on the middle, and black pile on the borders; pleurae yellowish brown, with yellowish pile, the pile black above. Scutellum concolorous with dorsum, with slightly longer black pile. Abdomen narrow, and gradually narrowing after the second segment, in color shining blue-black, the posterior margins of the second and third segments a little more blackish on the median two-thirds; hypopygium black. Pile of abdomen yellowish on basal angles, becoming white on the hypopygium, and black on the ends of the second and third segments. Legs chestnut brown. Wings distinctly luteous; stigma yellowish. Squamae and halteres white.

Holotype, ♂, Inverness, B.C., July, 1910, (J. H. Keen), in the Canadian National Collection, Ottawa.

Mallota columbiae, new species

Eyes bare; abdomen wholly black pilose; wings with a brown spot; thorax densely yellowish pilose. Distinguished from *cimbiciformis* by the shape of the angulation of the third vein, from *sackeni* by the open marginal cell.

Length 14 mm. *Female.* Face shining black, the sides covered with grayish yellow pollen, forming a complete band below the antennae. Front shining black, the sides with yellow pollen; pile of the head black, except a few whitish hairs on the cheeks; below the eyes there is a very distinct, triangular rust-colored spot. Antennae brown, third joint more reddish, large, broader than long; arista reddish. Thorax shining greenish black; anteriorly, except two narrow sub-median stripes, yellowish pollinose, in some lights a broader interrupted more shining stripe laterally. Scutellum light yellow. Pile of thorax and scutellum light yellow, the humeri and pleurae below with blackish hairs. Abdomen shining black, black pilose, but the sides of the second segment narrowly, with yellow hairs. Femora black, with black pile, tibiae more brownish,

tarsi reddish; tips of the femora, narrow base of the hind and broad bases of the anterior four tibiae, yellowish red; pile of the tibiae very short, brownish. Wings almost hyaline, with a brown cloud at the middle. Third vein with the angulation more V-shaped than U-shaped.

Holotype, ♀, Penticton, B.C., June 5, 1919, (R. C. Treherne), in the Canadian National Collection, Ottawa.

This species comes close to *cimbiciformis*, but is at once distinguished by the clouded wings, wing venation and facial profile. *M. sackeni* has the marginal cell closed. No other species with the abdomen practically entirely black pilose have been described; there are very few yellow hairs on the sides of the second abdominal segment.

Mallota diversipennis, new species

Eyes bare; antennae luteous-reddish; third longitudinal vein with the loop V-shaped; wings clouded; marginal cell open; pile of abdomen rather sparse, mixed black and fulvous.

Length, 15 mm. ♀. Face black, shining, covered, except a broad median stripe and the cheeks, with yellowish gray pollen, and sparse, long reddish yellow pile; front broad, the sides, more widely at the middle, with golden pollen, the pile rather sparse, reddish yellow, up the middle with black hairs, and chiefly black hairs across the ocellar triangle. Antennae luteous-reddish, shining, (third joint missing). Posterior orbits with brownish pile, but more fulvous below and at the vertex.

Thorax black, a little shining, with reddish pile; humeri reddish, sections of pleurae bordered with reddish and very slightly whitish pollinose; dorsum with slight indications of pollen before the suture. Scutellum yellow with moderately long, fairly abundant pale yellow pile.

Abdomen shining bluish black, with a purplish tint in some reflections; pile on first and second segments rather long, whitish, on the triangular median posterior half of second segment short, stiff, brown, elsewhere on the abdomen shorter, fulvous, sparsely intermixed with brown, on the third segment with a broad posterior band of short brown pile.

Femora brownish, hind ones more reddish; tibiae and tarsi yellowish red, the tibiae darker apically; pile of the anterior femora entirely black, rather long posteriorly, on the middle ones brown, but longer reddish yellow posteriorly, on the hind ones wholly reddish yellow; tibiae and tarsi with yellow pile; hind femora much thickened, the tibiae a little arcuate.

Wings with a distinct brownish cloud across the middle beyond which the color is somewhat luteous, the base hyaline. Angulation of third longitudinal very acute and V-shaped.

Holotype, ♀, in the Canadian National Collection, Ottawa, bearing no label. It is probably a Canadian specimen.

I cannot associate this species with any described. It comes nearest *palmerae* Jones but is distinct in the reddish antennae and color of the pile, that on the legs being especially distinctive. There is a short stump of vein into the first posterior cell from the tip of the V-shaped angulation.

Chilosia hunteri, new species

Eyes pilose; antennae reddish yellow; arista bare; facial slopes without pile; thorax whitish or yellow pilose, without spines, except a weak one on the mesopleura; abdomen light pilose.

Length 8 to 9 mm. *Male.* Face shining black, a little pubescent opposite the tubercle; side margins and below the antennae thinly silvery pollinose; face almost straight from base of antennal prominence to the oral margin which is on a plane with the antennal base, the tubercle fairly prominent, on a plane with the tip of antennal prominence, a little concave between the antennal prominence and tubercle, and shortly, deeply concave below the tubercle; the lower edge of the short nose-shaped tubercle is on a plane with the lower eye margins; side margins and cheeks short yellowish pilose. Frontal triangle shining black; finely moderately punctured, usually with a narrow sulca in the middle; the polished broad W on the antennal prominence reddish or obscurely so; pile of the frontal triangle black, rarely mixed with yellow; posterior orbits narrowly silvery pollinose, with white pile; remainder of occiput thinly grayish pollinose. Antennae with the first two joints polished brownish red, the third bright reddish yellow, not large, sub-quadrate, a little rounded apically. Eyes short brownish yellow pilose.

Thorax and scutellum shining metallic greenish black, with moderately short pale yellowish to yellow pile, a little deeper colored at the corners and usually with some black hairs intermixed here; there may be one to three weak bristles on the top of the mesopleura.

Abdomen of the same metallic greenish black color, but not quite so shining, and a little more sparsely finely punctured; second segment with a goblet-shaped opaque spot widest posteriorly and poorly outlined; an abbreviated, interrupted, basal opaque fascia on the third segment. Pile usually all pale yellowish or yellow but there may be some black hairs towards the end of the second segment.

Legs shining black, the trochanters obscurely reddish apically; femora tipped with reddish; tibiae with the basal quarter and a little less than the apical quarter reddish, the anterior ones a little more extensively reddish; tarsi all black, except that the base of the anterior four basitarsi may be reddish. The long hairs on the legs are yellow, the short ones black, except on the anterior of the front tibiae and the tarsal pads. Wings a little luteous, less so postero-apically; stigma and base of the wings brownish; 8 to 10 short bristles on R_{4+5}; tip of first posterior cell almost truncate, the last section of the fourth vein sinuous. Squamae slightly tinged with yellow, with white fringe of pile. Halteres reddish yellow, the end of the knob brown.

Holotype, ♂, Teulon, Manitoba, May 17, 1920 (A. J. Hunter) in the Canadian National Collection, Ottawa.

Paratypes, ♂, Teulon, Man., May 14, 1920, (A. J. Hunter) in the collector's collection; ♂, Teulon, May 17; ♂, Winnipeg, Man., May 7, 1910, (J. B. Wallis); in the writer's collection; ♂, Winnipeg, May 7, 1910, (J. B. Wallis) in the collector's collection.

This species is evidently close to *petulca* Will. but may be known by the bare arista, absence of scutellar bristles and the color of the vestiture. From

baroni it is distinguished by its reddish antennae, absence of spines and the color of the vestiture.

I take great pleasure in naming this species in honor of Dr. A. J. Hunter, who has sent me many fine specimens of Syrphidae, and whose efforts have added largely to our knowledge of the Syrphid fauna of Manitoba.

I place a female collected by Dr. Hunter at Teulon on May 14, 1920, here with some doubt as it appears rather darker.

Female. Face shining black, a little more prominent than in the male, as the oral tip is as prominent as the antennal base, the tubercle more prominent; third antennal joint larger, twice as broad as the second joint. Front brassy in the middle, the sides smoother, black; a slender longitudinal median shining darker stripe which is more or less impressed, and a transverse depression above the antennae; pile blackish above the antennae and at the ocelli, elsewhere fulvous; occiput dull, thinly grayish yellow pollinose, the pile whitish below, cinereous above. Eyes short fulvous pilose.

Thorax shining slightly brassy black, with a median rather broad vitta and a broad one sub-medianly on each side, less shining and darker. The pile on the thorax and scutellum is very short fulvous, but appears to be darker on the darker vittae, and on the immediate sides of the dorsum there are a few longer bristle-like black hairs and the pile on the end of the scutellum is partly black and subappressed.

Abdomen shining black with a brassy reflection, the disc of the second segment deep black. The pile is very short subappressed fulvous, appearing darker on the third and base of the fourth segment on the disc in some lights; on the base of the abdomen and anterior angles of the segments it is longer, on the fifth segment with some black hairs apically.

Legs as in the male but the tarsi brownish, the first joint of the anterior four tarsi reddish. Squamae white with a yellow fringe and pale yellow pile. Halteres yellowish red.

Myiolepta lunulata Bigot.

Bigot, (Ann Soc. Ent. France, 1884, page 537) described a specimen of *Myiolepta* from Oregon, giving it the specific name *lunulata.* As is the case with most of Bigot's descriptions the insect is not recognizable, and as a result Williston, (Syn. N. Am. Syrph., 1886) placed *lunulatus* as a synonym of *varipes* Loew. In the Museum of the California Academy of Sciences is a specimen of *Myiolepta* which is moderately like *varipes,* but there are certain differences which I can only regard as specific, and hence give a description of the specimen using Bigot's name *lunulatus* rather than a new one.

The specimen was collected at Huntington Lake, Fresno Co., California, at an altitude of 7,000 ft. by Mrs. E. P. Van Duzee and is a male.

Abdominal coloration in the male very much like the female of *M. varipes;* pile of abdomen depressed, mostly black; antennae dirty brownish yellow; wings clouded *only across the middle;* arista blackish.

Male. Length 7 mm. Swollen antennal base, cheeks and face from just above the tubercle to the mouth edge scarcely wider than the tubercle, deep shining black, the face elsewhere obscured by grayish yellow pollen. In pro-

file the face is very deeply concave; from the antennal prominence to the deepest part of the cavity it is almost straight, thence it is straight to the anterior oral margin, which does not project quite as much as the antennal prominence; the tubercle, situated in the middle of the lower straight portion, is moderately large, more rounded above, sub-pointed on its lower portion and almost at a right angle to the lower facial plane. Frontal triangle shining black, the sides narrowly grayish yellow pollinose. Vertical triangle black. Pile sparse, whitish, on the face restricted to the side margins.

Thorax and scutellum shining deep black; in front with an arch of grayish pollen extending between the humeri; pile short, yellow, subappressed; on the pleurae more erect, lighter. Scutellum margined with sparsely placed short black hairs.

Abdomen shining black; second segment except the sides and the base of the third segment medially, more opaque. First segment grayish pollinose. Second segment with a half-crescent-shaped yellow spot, extending along the latero-frontal margin a short distance, then curving back; behind and laterally to lunule the ground color is inclined to be lighter fading to black. Abdominal pile short, subappressed, on the abdominal basal angles, on the lighter areas and the basal triangles of the third segment, longer, whitish, more erect.

Legs black; bases of the tibiae piceous; hind tarsi and middle tarsi yellowish basally. All the femora thickened and bearing spines below. Hind tibiae without a triangular protuberance below. Wings subhyaline, darkened on the middle anteriorly. Stigma luteous, occupying the basal two-thirds of the cell.

Differs from *varipes* in that the wings are not clouded beyond the middle; pile mostly black on the abdomen; in the male of *varipes* the sides of the second abdominal segment are yellow; the face in *lunulata* is more produced and below the tubercle it is not receding to the oral margin as in *varipes*, but is continued forward.

NEW SPECIES OF THE SYRPHID GENUS CHILOSIA FROM CANADA (DIPTERA)

BY C. HOWARD CURRAN,
Orillia, Ont.

Chilosia sensua, new species.

Eyes bare; arista bare; wings strongly tinged with brownish yellow; scutellum without bristles; abdomen partly opaque.

Male. Length 7 mm. Face and front shining black, the former thinly grayish pollinose across below the antennae, pile of the side margins short, sparse, whitish, of the frontal and vertical triangles, black, of the posterior orbits, whitish below, yellow above. Eyes bare. Vertical triangle short, eyes touching for about the length of the vertical triangle. Frontal triangle large, a little prominent, with a metallic blue reflection in the middle, densely finely punctured; in the middle, when viewed from in front with an elongate triangular depression, its narrow base resting upon the antennal arch, its upper point almost reaching the juncture of the eyes. First antennal joint shining black, second piceous or brownish, third reddish, its end and upper portion more or less blackish, but

the ground color considerably obscured by whitish pubescence, in shape broader than long, flattened above, its upper apex more acutely rounded than the lower; arista black, bare, considerably thickened basally for about one-third its length (not as much as in *C. crassiseta* of Europe), then suddenly thinned.

Thorax and scutellum shining greenish black, the dorsum with a slight brassy reflection, covered with moderately short fulvous pile, but a stripe of black pile from the humeri to the base of the wings, and some black hairs about the postalar callosities.

Abdomen metallic greenish black; first segment with an opaque area on each side; second segment opaque black, the sides shining, the lateral ends of the opaque only very slightly concave and a little broader posteriorly; the opaque on the third segment is a little narrower than that on the second, does not quite reach the posterior margin and is not at all concave laterally. Pile of abdomen wholly fulvous.

Legs black, tips of the femora, bases of the tibiae and the apices of the front four tibiae reddish; basal tarsal joints brownish. Wings distinctly luteous, more clouded across the middle; stigma luteous; the first posterior cell ends in an acute angle. Squamae whitish yellow fringed with pale yellow pile. Halteres reddish.

Holotype, ♂, Orillia, Ontario, May 5, 1921 (Curran), in the writer's collection.

This species is related to *crassiseta* Becker of Europe, but the arista is not so much enlarged; differs from *capillata* in black pile of head, truncate shape of opaque of the abdomen and lighter colored legs, the face almost similar in profile; from *comosa* in the shape of the opaque markings and brownish wings; from *nigripennis* and *versipellis* in having yellow pile on thorax, etc.; from *parva* in the dark legs; from *ontario* in smaller size, different shaped antennae, arista, etc.

THE FAMILY POSITION OF PLATYPREPIA AND OTHER NOTES. (LEPID.)

BY HARRISON G. DYAR, A.M., PH.D.,

U. S. National Museum, Washington, D. C.

Some remarks by Dr. McDunnough seem to call for a little elucidation (Can. Ent., LIII, 167, 1921). I am quoted as claiming that *Platyprepia* belongs to the *Hypsidae*. This claim was not intended as original, as Dr. McDunnough's remarks seem to imply, but in following the established literature of the group it is well known that in Sir George Hampson's classic work, *Platyprepia* is omitted from the *Arctiidae*, together with *Callimorpha* (in the

Ed. Note.—The above article serves to elucidate Dr. Dyar's rather negative views in regard to the family position of *Platyprepia* but still leaves the correct position of this genus in doubt. The fact remains that the anastomosis of veins 7 and 8 of secondaries in *P. guttata*, a so-called Hypsid, is as long as, or even longer than that found in *Arctia caia*, the typical Arctiid.

Author's Note.—In estimating the length of the anastomosis, I do not count from the base of the wing to the point where veins 7 and 8 separate, which appears to be Dr. McDunnough's standard, but from the point where veins 7 and 8 fuse to where they separate again. In *Platyprepia*, these veins are free at the base, anastomose for about 3 mm., then separate. In *Arctia*, they are united to the base, making the length of the anastomosis about 7 mm. On this basis a more positive distinction can be made, and the reference of *Platyprepia* the Hypsidae retained.

European sense) and the groups which we used to call *Pericopidae, Nyctemeridae* and *Hypsidae*. These we expect him to treat under the family *Hypsidae* (*Callimorphidae*), except that his labors unfortunately terminated with the *Noctuidae*. I do not recall any statement by Hampson that *Platyprepia* belongs to the *Hypsidae;* but this seemed the only possible inference from his work that had appeared. After 1902 I regarded it as negatively established, and hence my remark which Dr. McDunnough refers to was briefly made.

It is also true that Sir George defines the family *Hypsidae* by having vein 8 of the hind wings connected with the cell by a bar. This can be verified by any of the *Hypsa* proper, and the definition remains unchanged in his latest publication (Nov. Zool., xxv, 389, 1918). However, in *Callimorpha*, the *Nyctemeridae* and *Pericopidae* the bar becomes a short anastomosis, as tacitly admitted by Hampson in his Moths of India (1894) where he places *Nyctemera* in the *Arctiidae*. The definition of the family thus becomes confused; but I have followed Sir George in his classification. Therefore Dr. McDunnough's remark that he would retain *Platyprepia* in "its present position in the *Arctiidae*" seems somewhat inappropriate, since *Platyprepia* has been omitted from the *Arctiidae* for the last twenty years by the most authoritative student of the world fauna, and not again restored by him in his latest reference (Cat. Lep. Phal. B. M., Suppl. vol. ii, 1920). If Dr. McDunnough wishes to differ from Hampson, which of course he has the right to do, the question of *Platyprepia* widens to include all of the *Pericopidae* and *Nyctemeridae*, for there is no difference that I can perceive in the venation. The anastomosis is shorter in these forms than in the *Arctiidae* in general, and if a more or less short anastomosis can be called a bar, it is possible to follow Hampson's classification, and this I suppose it is better to do if possible. Uniformity in nomenclature is so desirable that we should stretch a point to conform, if it can be done. For these reasons I would let *Platyprepia* remain in the *Hypsidae* instead of transferring it to the *Arctiidae* as Dr. McDunnough proposes.

Dr. McDunnough further refers to a similarity of larvae and male genitalia; but this similarity probably runs through all the groups mentioned.

In the same article Dr. McDunnough refers the species *alpina* Quensel to *Arctia* after showing the generic separation from *Hyphoraia*. In this he agrees with Hampson, who made the same reference and separation previously (Cat. Lep. Phal. B. M., Suppl. ii, 500, 1920). Hampson does not record *A. alpina* from America; but the European Arctic Fauna is the same as the American Arctic, apparently entirely, as far as these forms are concerned.

THE ENTOMOLOGICAL SOCIETY OF ONTARIO—ANNUAL MEETING

The fifty-eighth Annual Meeting of the Entomological Society of Ontario was held at the University of Toronto during the week of December the twenty-eighth. The meeting was held at this time in order to afford our members an opportunity of meeting with the members of the Entomological Society of America and of the American Association of Economic Entomologists.

Among the members present were Dr. C. J. S. Bethune, Toronto, Ontario; Mr. J. D. Evans, Trenton, Ontario; Prof. J. H. Comstock, Ithaca, N.Y.; Dr. L. O. Howard, Washington, D.C.; Dr. E. P. Felt, Albany, N.Y.; Prof. E. M. Walker, Dr. W. A. Clemens, Dr. Craigie, Mr. Bigelow and Miss Norma Ford, Toronto University; Messrs. A. Gibson, Dr. Swaine, L. S. McLaine, R. C. Treherne, H. G. Crawford and F. C. Craighead, Dominion Entomological Branch, Ottawa; Profs. L. Caesar and A. W. Baker and Messrs. G. J. Spencer and W. G. Garlick, O. A. College, Guelph, Ont.; Miss Edna Mosher, Albuquerque, N. M.; Father Leopold, La Trappe, Ont.; Prof. W. H. Brittain, Truro, N.S.; Mr. F. J. A. Morris, Peterborough, Ont.; Dr. J. D. Detwiler, Western University, London, Ont.; Mr. C. H. Curran, Orillia, Ont.; Mr. W. E. Biggar, Hamilton, Ont.; Prof. A. V. Mitchener, M.A. College, Winnipeg, Man.; Dr. Matheson and Mr. H. C. Huckett, Cornell University, Ithaca, N.Y.; Drs. S. Hadwin and A. C. Baker, Washington, D.C.; and the following officers of the Dominion Entomological Branch:—Messrs. G. E. Sanders, Annapolis Royal, N.S.; J. D. Tothill, Frederickton, N.B.; C. E. Petch, Hemmingford, Ont.; W. A. Ross, Vineland Station, Ont.; H. F. Hudson, Strathroy, Ont.; Norman Criddle, Treesbank, Man.; E. H. Strickland, Lethbridge, Alta.; and W. Downes, Victoria, B.C.

The meetings were also well attended by members of the Entomological Society of America, the American Association of Economic Entomologists and others.

On Wednesday afternoon a meeting was held with the Entomological Society of America in Room 10, Medical building. The following papers were contributed by members of the two societies.

Algonquin Days,—F. J. A. Morris, Peterborough, Ont.

Hatching in Three Species of Neuroptera.—Roger C. Smith, Kansas State Agricultural Society.

Ecdysis in Tmetocera Ocellana.—S. W. Frost, Arendtsville, Pa.

Cocoon Spinning by Species of Bucculatrix.—O. A. Johannsen, Cornell University.

The Ventral Pro-Thoracic Gland of the Red-Humped Apple Caterpillar (Schizura concinna)—J. D. Detwiler, Western University.

Observations on a New Species of Chrysops From Central New York.—Raymond C. Shannon, Cornell University.

Are There Two Species of the Oyster-Shell Scale?—Grace H. Griswold, Cornell University.

A Classification of the Larvae of Tenthredinoidea.—H. Yuasa, University of Illinois.

The Phylogeny of the Gall Mites and a New Classification of the Suborder Prostigmata of the Order Acarina.—H. E. Ewing, United States National Museum.

The Syrphid Genera Hammerschmidtia and Brachyopa in Canada.— C. Howard Curran, Orillia, Ontario.

Taxonomic Results from a Study of the Genitalia of Male Syrphidae.—C. L. Metcalf, University of Illinois.

Report of the Lepidoptera of the Cornell Expedition of 1919-1920.—Wm. T. M. Forbes, Cornell University.

An Extreme Case of Delayed Fall Emergence of Hessian Fly (Phytophaga destructor)—W. H. Larrimer, United States Bureau of Entomology.

Importance of Insects in the Food of the Brook Trout.—W. A. Clemens, University of Toronto.

The Effect of Vitamines on the Growth of Ephestia Kuehniella in Wheat Flour.—Charles H. Richardson. United States Bureau of Entomology.

On Friday afternoon the Society met with the American Association of Economic Entomologists when the following programme was delivered.

One Year of the Crop Protection Institute.—W. C. O'Kane, Durham, N.H.

Poisoned Molasses for the Destruction of Noctuid Moths.—E. H. Strickland, Ottawa, Canada.

The Western Wheat Stem Sawfly in Canada.—Norman Criddle, Treesbank, Manitoba.

Progress in Hessian Fly Control.—H. A. Gossard, Wooster, Ohio, and T. H. Parks, Columbus, Ohio.

European Corn Borer: Life History in Ontario.—H. G. Crawford, Ottawa, Canada.

European Corn Borer: Present Distribution in Ontario.—L. S. McLaine, Ottawa, Canada.

European Corn Borer: Control Under Ontario Conditions.—G. J. Spencer, Guelph, Ontario, Canada.

The Corn Borer Problem in New York State.—E. P. Felt, Albany, N.Y.

Chemotropism of Chinch Bug.—H. Yuasa, Urbana, Ill.

Observations on Insects Attacking Sorghum.—Wm. P. Hayes, Manhattan, Kansas.

The Onion Maggot in British Columbia Under Irrigated Conditions.—R. C. Treherne, Ottawa, Canada.

The Cabbage Root Maggot.—L. Caesar, Guelph, Canada.

A Forest Insect Survey from the Air.—J. M. Swaine, Ottawa, Canada.

Forest Sample Plot Studies in a Spruce Budworm Outbreak.—F. C. Craighead, Ottawa, Canada.

The Life History, Habits and Injuries of the Maple Case-Bearer.—Glenn W. Herrick, Ithaca, N.Y.

On Friday evening an entomologists' dinner was held at the Prince George Hotel under the auspices of the American Association of Economic Entomologists. Many members of our society accepted the kind invitation of this society to be present.

The business meeting was held on Saturday morning. Considerable discussion in regard to the financial condition of the society took place. The following officers were elected for the ensuing year:

President—Mr. F. J. A. Morris, Peterborough.

Vice-President—Dr. J. M. Swaine, Entomological Branch, Ottawa.

Secretary-Treasurer—Prof. A. W. Baker, O.A. College, Guelph.

Curator and Librarian—Mr. G. J. Spencer, O.A. College, Guelph.

Editor—Dr. J. McDunnough, Entomological Branch, Ottawa.

Auditors—Prof. L. Caesar and Mr. J. A. Flock.

The directors were re-elected save that Dr. J. D. Detwiler was appointed director in division No. 5.

THE ENTOMOLOGICAL SOCIETY OF AMERICA

At the very successful annual meeting of the above society, held in Toronto during the week of December 28th, the following officers for 1922 were elected.

PRESIDENT—Arthur Gibson, Dominion Entomologist, Ottawa, Canada.

FIRST VICE-PRESIDENT—Dr. W. A. Riley, University of Minnesota, St. Paul.

SECOND VICE-PRESIDENT—Professor R. A. Cooley, University of Montana, Bozeman, Mont.

SECRETARY-TREASURER—Dr. C. L. Metcalf, University of Illinois, Urbana, Ill.

ADDITIONAL MEMBERS OF THE EXECUTIVE COMMITTEE:

Dr. J. M. Aldrich, United States National Museum, Washington.

Mr. Wm. T. Davis, New Brighton, N.Y.

Dr. E. M. Walker, University of Toronto, Toronto, Ontario.

Dr. O. A. Johannsen, Cornell University, Ithaca, N.Y.

MANAGING EDITOR OF THE ANNALS—Dr. Herbert Osborn, Ohio State University, Columbus.

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Dr. Frederick C. Muir, H.S.P.A. Experimental Station, Hawaii.

ASSISTANT MANAGING EDITOR—Dr. C. H. Kennedy, Ohio State University, Columbus.

A.W.B.

JOHN MACOUN MEMORIAL VOLUME.

The Ottawa Field-Naturalists' Club have issued a prospectus of the proposed autobiography of the late Professor J. Macoun, Canadian Explorer and Naturalist, who occupied the position of Director and Naturalist to the Geological Survey of Canada. It is expected that a sufficient number of subscriptions for this Memorial Volume will be received and that the same will be published and ready for mailing in the autumn of 1922. It is expected that the manuscript will make a volume of between 300 and 400 pages. The Treasurer of the Committee, Mr. Arthur Gibson, Dominion Entomologist, Birks Building, Ottawa, is receiving subscriptions for the price of the Volume, namely $3.00.

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POPULAR AND PRACTICAL ENTOMOLOGY

Notes on Some Insects Affecting Native Cottonwoods

BY WALTER CARTER,

Dominion Entomological Laboratory, Lethbridge, Alta.

The cottonwood grows to a considerable size in the river bottoms in Alberta. It has a rapid growth, and this, together with the shade it affords renders it very valuable as an ornamental tree on the prairies. Trees planted ten and eleven years ago on the Experimental Farm at Lethbridge are now 10 to 15 inches in diameter. A feature of the trees' growth, which led to the following observations, is the cracking of the old bark, especially around the bases of the branches, and a constant exudation of sap. This is seasonal and apparently of not much consequence to the tree, though it should be mentioned in this connection that all the trees referred to are growing under irrigated conditions.

On June 28th, 1921, attention was drawn to large unsightly masses of faecal matter in the cracks of the bark, and on examining these, colonies of a noctuid larva were disclosed, apparently feeding on the bark. Examination of all the cottonwoods in the vicinity showed these colonies to be present in the cracks or in pruning wounds where the sap was exuding.

The larvae were closely packed together, were entirely concealed, and negatively phototropic. They were unable to crawl on the smoother surface of the tree, and once removed from the moist strands of old bark were unable to return.

Much of the fresh faecal matter was light green, which suggested that living tissues were being fed upon. Fresh intestinal contents showed cortical and xylem elements present which had all the usual appearances of living plant cells. It is apparent therefore, that the larvae do not confine their attentions to old bark, but feed on living tissues—apparently the scoring noticed on the new bark is a result of their activities. Specimens reared in the laboratory were fed on pieces of bark taken from the neighborhood of the colonies. About fourteen pupated, and several other pupae were obtained from the cottonwoods.

While looking for these latter, we found that numerous other forms of life inhabited these cracks in the bark. Mites, weevils, spiders, and many forms of dipterous larvae were abundant, as well as the pupæ of more than one species of noctuid moth. Some of these latter proved to be *Rhynchagrotis placida* Grt.

and two larger pupæ were obtained from which later a Catocala species emerged. The larvae of the last mentioned were also found on the tree and two individuals were found pupating under the bark.

The pupæ of the principal species mentioned in this article were found in the trees on July 1st, in cocoons made of old strands of bark intermingled with silk. Specimens reared indoors pupated July 10th and 11th. These specimens emerged from the 30th of July to the 5th of August and were determined by Dr. McDunnough as probably *Ufeus plicatus* Grt.

Control:—The question of the control of the *Ufeus* species was given attention during the summer. Of all the colonies examined, over 80 per cent. failed to mature through natural causes. *Apanteles* sp. emerged on July 10th, from a mass of cocoons attached to a dead larva. Such masses were present on most of the colonies. Tachinid larvae were taken from a diseased specimen during the examination of intestinal contents, and a tachinid puparium was obtained from one of the reared specimens. A disease, with symptoms very much like flacherie, accounted for many of the colonies, wiping them out completely. Where the sap ceased to exude before the colony was mature, the bark dried out and the colony died.

Mention might also be made of the fact that of five *R. placida* pupæ obtained, three produced very beautiful green-bodied hymenoptera, and an *Apanteles* sp. emerged from one of the *Catocala* larva after it had spun its cocoon. Artificial control experiments were not very satisfactory owing to the difficulty in maintaining controls. An ordinary hand sprayer was used and mixtures containing Paris green sprayed into the cracks where colonies existed, but without any effect whatever. Pieces of sodium cyanide placed in the cracks destroyed the colonies completely in twenty-four hours.

The best control, however, was the simple one of carefully pruning away the splitting bark from around pruning wounds and other places in the tree where the bark naturally breaks away. The adult of the larvae is evidently an opportunist, laying its eggs in these cracks as it finds them. Cleaning up such places improves the appearance of the tree, involves the destruction of all the season's hatch, and reduces future breeding places. As cottonwoods are usually grown in small numbers as shade trees and windbreaks, such a plan is practical.

The tree survives the presence of the colonies, but the larvae spoil its appearance, with masses of faecal matter, and keep wounds open, causing decay. Several trees were noticed in which such places were full of water, and harbored numberless dipterous larvae which fed on the decaying matter.

The tree, once it attains a fair size is apparently immune, as none of the mature trees in the river bottom at Lethbridge showed any sign of the presence of larvae.

The habits of *Ufeus* in thus using cottonwoods as a breeding ground is apparently of wide occurrence, since in Montana *Ufeus* on cottonwoods is reported in several of the yearly reports of that state.

SOME NEW AND RARE COLEOPTERA FROM SOUTHWESTERN FLORIDA

BY W. S. BLATCHLEY,

Indianapolis, Ind.

(Continued from Page 14)

Eros trilineatus Melsh.—An individual of this species was taken at Dunedin having the left elytron only two-thirds the length of the right one.

Chauliognathus marginatus Fab.—Examples of this common species are at hand from Miami and Everglade having the thorax entirely yellow and the black spots on head very small.

Belotus (*Lobetus*) *abdominalis* (Lec.)—Taken at Dunedin in some numbers, April 10—15, by sweeping the new low vegetation on lots which had been recently burned over. Schwarz records it as "common on swampy meadows in June."

Attalus australis sp. nov.

Oblong-oval, wider behind. Black, strongly shining, elytra faintly tinged with blue; femora shining black; labrum, palpi, antennae, tibiae and tarsi, pale reddish-yellow; upper surface thinly clothed with sub-erect grayish pubescence. Head wider than long, narrower than thorax, almost impunctate; eyes large, prominent; antennae reaching middle of body, male, base of thorax, female; rather stout, not serrate, the joints one-half longer than wide. Thorax suborbicular, two-thirds wider than long, front margin truncate, disc very minutely and sparsely punctate. Elytra not wider at base than thorax, gradually expanding and widest about apical third, finely but more distinctly punctate than thorax, each puncture, as there, bearing a sub-erect grayish hair. Length 1.3-1.8 mm.

Swept in some numbers, Feb. 21-27, 1919, from low vegetation along the inner margin of the beach at Cape Sable. The pale tibiae and tarsi contrast strongly with the black femora. The blue-black upper surface and posteriorly widened elytra give it the appearance of a *Pseudobaenus*, but the male and female elytra are similar in form.

Melyrodes (*Melyris*) *basalis* (Lec.)—One specimen taken at Dunedin, April 11, by sweeping ferns in Skinner's Hammock. The only other definite Florida record is that of Dozier[14] who has taken it at Gainesville.

Cymatodera undulata (Say)—One specimen at Dunedin, February 23, by beating bunches of Spanish moss. No previous Florida record except that of Leng in his Catalogue.

Thanasimus dubius (Fab.)—One, February 17, beneath a stick of corded pine wood near Dunedin. The first record for the State, though the general range is given by Leng as Canada and New England to Mexico.

Hydnocera humeralis Say.—One, April 12, at Dunedin by sweeping low vegetation in dry, sandy soil. No previous definite station record for the State.

[14]Ent. News, XXIX, 332.

Zonitis schæfferi sp. nov.

Elongate, subcylindrical. Head yellow, with a large subquadrate piceous spot between the eyes; antennae piceous, the basal joints black; thorax yellow with a rosaceous tinge; elytra piceous, with narrow sutural, median and marginal stripes yellow; under surface and legs black, shining, the trochanters wholly, and coxae in part, yellowish. Head subquadrate, coarsely and densely punctate; eyes transverse, widely separated above and beneath; antennae stout, slightly less than half the length of body. Thorax slightly wider than long, sides almost straight from base to apical third, hind angles rounded, disc densely and coarsely punctate, a median impressed line on basal half. Elytra densely and coarsely rugose-punctate. Under surface rather finely, not densely punctate; last ventral with a very broad U-shaped emargination. Length 9 mm.

Described from a single male beaten, February 9, from dead vines by the side of a roadway running through Skinner's hammock near Dunedin. In form and sculpture it resembles *Z. longicornis* Horn, but the antennae are stouter and much shorter and they and the legs are almost wholly blackish. The median discal stripe of elytra narrows gradually from the base and does not reach the apex. Named in honor of Chas. Schæffer of Brooklyn, New York, who, by his careful and discriminating studies has done much to advance our knowledge of the Coleoptera of North America.

Phomalus (*Xylophilus*) *brunnipennis* (Lec.)—A single specimen was beaten from a bunch of Spanish moss near Dunedin, on March 23. This is the first Florida record, though it is said to range from the District of Columbia and Indiana to Southern California. It is placed in the family Euglenidae by Leng.

Drapetes geminatus Say.—

Drapetes quadripustulatus Bonv.—While these two species have been mentioned as occurring in Florida by a number of persons, definite recorded stations from the State are very few. One specimen of each has been taken at Dunedin, *geminatus* on April 14 by sweeping ferns in a dense wet hammock, and *quadripustulatus* on April 12 from a low huckleberry on dry sandy soil. Schwarz records both as "very rare," *geminatus* from Enterprise and *quadripustulatus* from Tampa.

Buprestis striata impedita Say.—One example of this handsome Buprestid was taken March 7, from a window of my residence in Dunedin. Not before known from Florida, and perhaps an adventive.

Cyphon americanus Pic.—This is the *C. impressus* Lec. described[15] in 1878 from specimens taken by Schwarz on swampy meadows at Tampa and Enterprise, and not since recorded from the State. It occurs in small numbers about Dunedin in April, in company with *C. variabilis* Horn, on the flowers and foliage of huckleberry. LeConte's name was preoccupied. Schæffer (Ms.) states that, "as far as known, the elytral impressions are present only in the females."

Trogoderma flabellata sp. nov.

Oblong-oval. Black, shining, rather densely clothed with fine pubescence which is blackish and suberect on head and thorax, yellowish and subprostrate

[15]Proc. Amer. Phil. Soc., XVII, 405.

on elytra; each elytron with a narrow irregular orange-red band just in front of middle, this concave behind and widest near the suture; femora and antennae fuscous; tibiae and tarsi reddish-brown. Head densely and finely punctate; eyes entire, separated by three times their own diameter. Antennae flabellate, the branches of joints 4 to 10 three or four times the length of the segments, those of two and three shorter. Thorax about twice as wide as long, sides broadly rounded, base as wide as elytra, strongly bisinuate, disk densely and finely punctate. Elytra conjointly scarcely twice as long as wide, finely and rather closely aciculate punctate. Prosternum very coarsely and closely punctate, the process feebly carinate. Length 2.1-2.3 mm.

Described from two males, one taken at Dunedin, February 14, the other at Caxambus, March 9; both by sweeping low shrubs along tidewater lagoons. In general appearance this is a miniature of my *T. fascifera*, but the flabellate antennae, narrower cross band of elytra, more coarsely punctate prosternum and much deeper antennal fossae are, in addition to its small size, distinctive characters.

Trogoderma fascifera Blatch.—A second male of this species was beaten, March 22, from dead leaves of a cabbage palmetto on Hog Island. The unique type was from the shore of Lake Istokpoga.

Tenebroides obtusus (Horn.)—One specimen, January 21, from beneath bark of a pine block at Dunedin. Described[16] from Pennsylvania and District of Columbia, and not heretofore known from Florida.

Lophocateres pusillus (Klug.)—One specimen, February 6, from beneath a board lying on the ground in a barnyard near Dunedin. An introduced species originally described from Siam, and known in this country from South Carolina, Louisiana and Texas.

Cybocephalus nigritulus Lec.—Examples of this minute Nitidulid have been taken on Hog Island opposite Dunedin, in February and March, by beating the Florida button-bush, *Conocarpa erecta L.*

Lathropus vernalis Lec.—One specimen swept, March 29, from huckleberry blossoms near Dunedin. Hitherto known from the State only from Crescent City.

Aulonium tuberculatum Lec.—Several specimens were taken near Dunedin in January, in company with *Lasconotus pusillus* Lec., and *Hypophlocus thoracicus* Melsh., beneath the bark of freshly cut pine blocks. It is noted in the Schwarz Manuscript as found at Jacksonville by Ashmead.

Monocdus guttatus Lec.—A number of examples were taken at Chokoloskee by beating its host plant, the slender twining milkweed, *Metastelma scoparium* Nutt. In normal specimens the body is covered with a whitish waxy secretion. In some of those from Chokoloskee this was lacking and the usual small scattered dark spots of elytra were very faint or wholly wanting.

Alphitobius piceus (Oliv.)—Nearly a hundred specimens of this cosmopolitan species were taken March 9 in company with scores of *Dryotribus mimeticus* Horn from beneath two pieces of decaying lumber near an old sugar furnace at Caxambus. Single specimens have also been found on two occasions at Dunedin.

[16]Proc. Acad. Nat. Sci. Phil., 1862, 87.

Ptinus constrictus sp. nov.

Elongate, subparallel. Dark reddish-brown, the antennae, legs and under surface slightly paler. Head coarsely and densely punctate, clothed with suberect yellowish bristle-like hairs; occiput with a deep median groove; eyes quite prominent, coarsely facetted; antennae three-fifths the length of body, joints 2 and 3 each two-thirds the length of 4, 4 to 11 subequal, densely pilose. Thorax subcylindrical, strongly constricted near base, both disc and constriction densely and coarsely punctate, the former bearing each side near the middle a triangular tuft of stiff yellowish hairs. Elytra three times as long as broad, sides parallel; striae feebly impressed, marked with rows of fine, close-set punctures; intervals about twice the width of the striae, each with a row of minute punctures, the punctures of both striae and intervals each bearing an inclined yellowish hair. Sterna smooth, glabrous; abdomen thickly clothed with fine yellowish pubescence. Length 2.6 mm.

A single male was beaten, March 15, from dead branches in a partially cleared mangrove swamp on Chokoloskee Island. Mr. Fall, to whom it was submitted, stated that in his table[17] it should probably be placed between *strangulatus* and *falli*.

Onthophagus alutaceus Blatch.—This species was described[18] from a unique, taken on the wing at Dunedin. A second specimen was obtained January 21, by beating the foliage of a water oak near the bay front, one mile north of the town. The representatives of the genus usually occur on the ground about carrion, horse dung and other refuse.

Ligyrus subtropicus sp. nov.

Oblong, suboval, very robust, convex. Above piceous-black or very dark chocolate-brown, strongly shining; under surface and appendages dark reddish-brown. Head at widest part two-fifths the greatest width of thorax, finely and shallowly rugulose; clypeus subtriangular, its sides rapidly converging from the very broad base, its apex bifid, the teeth upturned and well separated, extreme base with two blunt tubercles behind which the interocular space is visibly concave. Thorax one-third wider than long, sides broadly curved, hind angles rounded, disc finely, sparsely, irregularly aciculate-punctate and very minutely alutaceous; front margin with a short blunt median tubercle behind which is a shallow oval pit or impression, this punctate like the disc. Elytra as wide at base and just twice as long as thorax, their tips broadly rounded and exposing both the last dorsal segment and the very large pygidium; disc with sutural striae well marked, the others feeble and irregular, all with coarse punctures extending throughout the length; first, third and fifth intervals much wider than the others, and with numerous confused punctures as coarse as those of the striae. Pygidium minutely scabrous at base, elsewhere very finely and sparsely punctate. Ventral abdominal segments very finely and remotely punctate, each with a single interrupted transverse row of much coarser punctures. Middle of prosternum and median tubercle behind the front coxae each with a tuft of

[17]Trans. Amer. Ent. Soc., XXXI, 1905, 113.
[18]Can. Ent., LI, 1919, 31.

long reddish bristles. Front tibiae with three large anterior teeth and a very small posterior one. Length 27 mm., width 13 mm.

A single female of this large Scarab was taken at light at Dunedin, June 4, 1913, and has since been in my collection without a name. I finally sent it to Mr. Fall, who returned it as a "*Ligyrus* near to *bryanti* Rivers, which it is not." Col. Casey then passed judgment upon it as follows: "Your specimen belongs to my subgenus *Grylius* and represents a species near to the Florida individual described by me[19] as *luctivolus* Bates, but is a different species. It is larger and much stouter, has coarser elytral punctures and a different form of pronotal apical impression."

Euphoria sepulcralis floridana Casey.—The types of this sub-species[20] were from the "East Coast of Florida, Jacksonville to Palm Beach." A specimen at hand was taken at Ocala on April 14.

Euryptera lateralis (Oliv.)—A dozen examples of this handsome Lepturid were taken February 21 from the blossoms of a Cherokee rose, in my lot at Dunedin. It is listed by Schwarz as "very rare" at Tampa and Enterprise, and has been taken also at St. Augustine and Crescent City.

Euryptera flavatra Blatch.—A second example of this bicolored species was taken from a blossom of the same rose on April 9. Only the unique type, described[21] from Dunedin, was previously known.

Leiopus maculipennis sp. nov.

Oblong, moderately robust. Above dull reddish-brown, thickly and evenly clothed with short, prostrate grayish-yellow hairs, with small patches of white and black ones intermixed; the white patches alternating with the black along each sutural carina, forming a narrow, much interrupted bar across elytra at apical third, and sometimes another half way between it and apex, the black patches arranged in four rows as suberect tufts along the disc of each elytron; antennae and legs indistinctly but perceptibly annulate, the apical third of middle and hind tibiae fuscous; under surface piceous, thickly clothed with long grayish hairs. Antennae surpassing tips of elytra 3-5 mm., the basal joint thick, subclavate; second one-fourth longer than any which follow, these being subequal. Thorax more than one-third wider than long, sides almost straight from apex to summit of lateral tubercle, which is short, subacute and placed at basal fourth; disk very finely and densely punctate. Elytra one-third wider at base than thorax, sides straight to apical third, tips subtruncate, the sutural angle slightly prolonged; disk finely and rather sparsely punctate. First joint of hind tarsi as long as the next two. Length 5.5-6.5 mm.

Described from ten specimens taken at Dunedin; one December 5, the others between March 12 and April 19. Occurs on dead vines and twigs in dense hammocks. This species has been in my collection unnamed since 1916, and specimens have been compared with those of all other species in the Horn and LeConte collections at Philadelphia and Cambridge, and also by Mutchler

[19]Memoirs VI, 1915, 190.
[20]Memoirs VI, 1915, 321.
[21]Can. Ent. XLVI, 1914, 92.

with those in the American Museum. It belongs in the group with *crassulus* and *centralis* Lec., but differs from all our described species in lacking all trace of dark bands on the apical half of elytra, in the very distinct and handsome maculation of the sutural carinae, etc.

Oberea flavocephala sp. nov.

Elongate, subcylindrical. Black, strongly shining, thinly clothed with minute grayish pubescence and scattered erect black hairs. Head and thorax bright yellow, the former with two spots on occiput, one behind each eye and labrum and mandibles black; thorax with two large callosities, a small subquadrate spot in front of scutellum and a triangular one each side on lower posterior flank, shining black; tibiae and tarsi piceous. Head coarsely and densely punctate; antennae a little shorter than body, the outer joints slightly stouter than the third and fourth. Thorax coarsely and closely punctate, the two black callosities twice or more as large as in *bimaculata*, each circumscribed near the edge by a series of very coarse punctures. Elytra with rows of coarse, dense punctures, the intervals very narrow, the third slightly raised nearly throughout its length; tips truncate, their inner and outer angles distinctly produced or dentiform. Abdomen finely and very sparsely punctate. Length 8.5-9.5 mm.

Two swept from low herbage along the margin of a dense hammock near Dunedin, April 9-24; one from Ormond, April 14. The Ormond specimen, taken in 1913, was labelled *bimaculata* Oliv., but on taking the two Dunedin examples I saw that they differed widely from that species in the yellow head, large coarsely punctate thoracic callosities and armed elytral tips. It is evidently allied to *insignis* Casey[22] from North Carolina, but that is a larger species with rounded spot in front of scutellum and elytral tips unarmed.

Cryptocephalus calidus Suffr.—This species occurs in dry localities about Dunedin during December and January, on the foliage of huckleberry and other low shrubs. I first recorded it from there in 1917, but Leng does not definitely include Florida in its distribution.

Cryptocephalus aulicus Hald.—Three specimens were swept on April 8, from low vegetation along the edge of a hammock.

Disonycha caroliniana (Fab.)—In the Schwarz Manuscript this species is mentioned as occurring at Enterprise and Ft. Capron. A single specimen was taken December 16 by sweeping near Dunedin.

Colaspidea insularis sp. nov.

Oblong-oval, convex. Brown with a shining brassy tinge, antennae, tibiae and tarsi paler; surface sparsely but evenly clothed with white scale-like hairs. Head with front finely and sparsely punctate, and with a broad, shallow median impression; antennae slender, reaching middle of elytra, joint two equal in length but more slender than one, curved, 3-6 subequal to two, 7-10 stouter, subequal in length. Thorax one-half wider than long, its front margin curved and somewhat projecting to cover occiput; sides broadly rounded, disk finely

[22]Memoirs IV, 370.

not closely punctate. Elytra conjointly oval, one-fourth wider at base than thorax, umbone prominent; disk evenly, closely and rather finely punctate, the umbone and three or four elongate calloused spaces near middle of each elytron smooth. Under surface very finely and sparsely punctate; prosternum forming a large flat quadrate plate between the front coxae. Length 2.7-3 mm.

Described from three specimens from the Isle of Pines received, among other material for naming, from Prof. J. R. Watson, of the Florida Agricultural Experiment Station. They were labelled "on citrus," and Prof. Watson writes that he has considerable correspondence with citrus growers on the Isle of Pines, who are unable to get satisfaction from the Cuban station. Four species of *Colaspidea* have hitherto been described from North America, all from Southern California or adjacent islands. According to Horn,[23] others are known "from Southern Europe and the circum-Mediterranean region generally." Since Leng and Mutchler mention no species of the genus in their list of West India Coleoptera, *insularis* is apparently the first one to be known from the Atlantic region of North America.

Haltica schwarzi Blatch.—Described[24] from the east shore of Lake Okeechobee. Two specimens were secured on March 4 while sweeping low huckleberry near the edge of a brackish water marsh just east of Ft. Myers.

TWO FAMILIES OF INSECTS NEW TO BRITISH TERTIARY STRATA

BY T. D. A. COCKERELL,

University of Colorado.

When recently examining some hitherto overlooked fossil insects in the British Museum, I found two specimens collected by Mr. a'Court Smith in the Isle of Wight, representing families not yet recorded from the British Tertiary rocks. They come from the Bembridge series, at the famous Gurnet Bay locality.

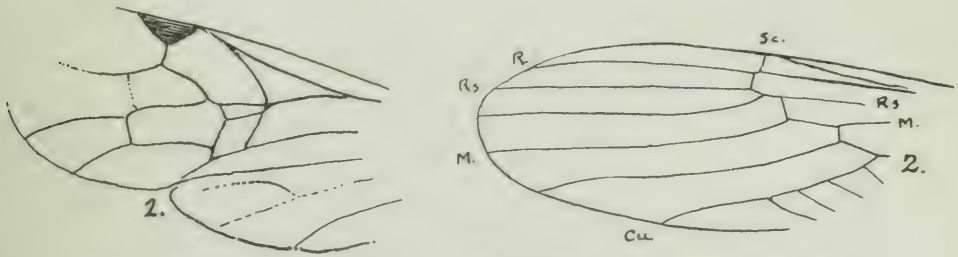


Fig. 1, wing of *Vectevania vetula*; Fig. 2, wing of *Nemoura priscula*.

EVANIIDAE.

Vectevania n. gen.

Related to *Protofoenus* Ckll., from Burmese amber, but differing especially in the complete third discoidal cell and the deep triangular stigma. The second transverse-cubital nervure is so faint as to be practically obsolete, and there is perhaps a slight indication of the third, too vague to be positively recognized.

[23]Trans. Amer. Ent. Soc., XIX, 1892, 204.
[24]Can. Ent., XLVI, 1914, 141.

The position of the second is as in the living *Neuraulacinus braunsi* Kieffer. The small cuneiform first discoidal cell is characteristic, and the comparatively distinct venation of the hind wings is a primitive feature, lost in the modern *Aulacinus*, but preserved in *Neuraulacinus*.

Vectevania vetula n. sp.

Head narrower than thorax; thorax elongate-oval, 2 mm. long; abdomen claviform, nearly 3 mm. long, obtuse at apex; anterior wing about 4.5 mm. long, clear hyaline, with ferruginous nervures; stigma margined with brown, apparently originally all brown.

British Museum, In. 20535.

PERLIDAE.

Nemoura (sens. lat.) priscula n. sp

Anterior wing, length about 5.4 mm., width nearly 2 mm.; colorless. About 1.7 mm. of the base is lost. The venation is very simple, but similar in principle to that of *Nemoura*. From the fork of the radial sector to the apex is nearly 3 mm. Comparing the venation with recent species, I found nothing very close, and it is probable that a distinct genus is indicated. Some of the species from Prussian amber are interesting for comparison. Thus *Taeniopteryx elongata* Berendt has the cross-nervure at the end of the subcosta, but it is oblique. *Leuctra gracilis* Berendt and *Leuctra linearis* Berendt have this cross-nervure well before the end of the subcosta, in *gracilis* producing an angulation of the subcosta, but not in *linearis*. On the other hand, *L. gracilis* agrees with the English fossil in having the cross-vein connecting R with R_5 beyond the fork of R_3; in the other two amber species it is at the fork. Our fossil nearly agrees with *L. gracilis* in the position of the cross-vein between R_3 and M.

British Museum, In. 17498.

Thirteen species of Perlidæ have been found in Baltic amber, and one in the Oligocene of Rott, but strangely enough none in the American Tertiaries.

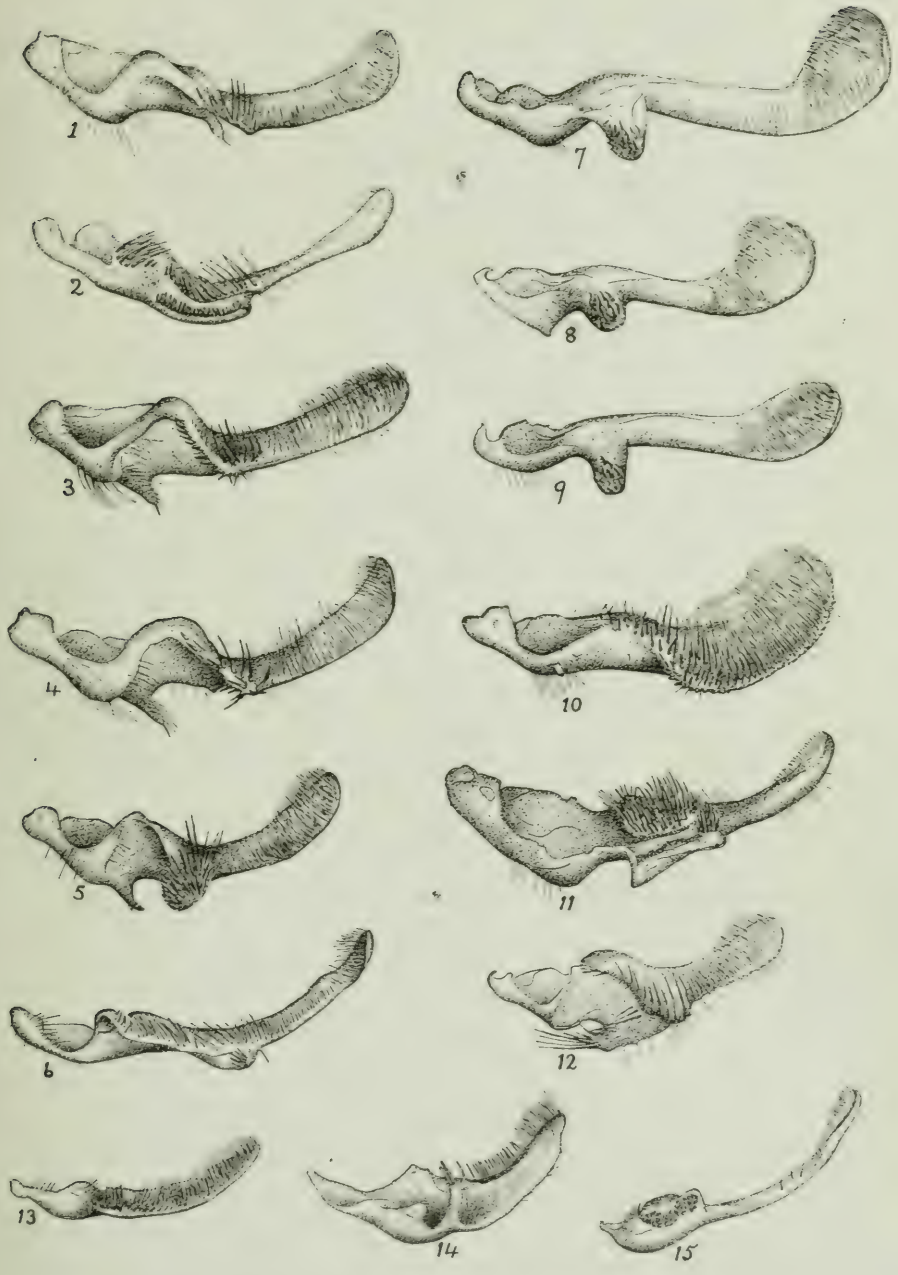
UNDESCRIBED LEPIDOPTERA IN THE CANADIAN NATIONAL COLLECTION.

BY J. MCDUNNOUGH,

Entomological Branch, Ottawa.*

For some time there has been a strong feeling among Canadian entomologists that the types of as many as possible of our Canadian insects should be deposited in the National Collection at Ottawa. During the past half century, owing to the lack of taxonomists in Canada, a large proportion of Canadian insect material has been sent to the United States or Europe for identification and as a result the types of numerous undescribed species have been retained in these countries. With the growth of taxonomy and the discovery of numerous closely allied forms which heretofore had been grouped

*Contribution from the Entomological Branch, Department of Agr., Ottawa



UNDESCRIBED LEPIDOPTERA.

Male clasper of 1. *Exartema permundanum* Clem.; 2. *E. troglodanum* n. sp.; 3. *E. furfuranum* n. sp.; 4. *E. rusticanum* n. sp.; 5. *E. bolanderanum* n. sp.; 6. *E. terminanum* n. sp.; 7. *Argyroploce youngana* n. sp.; 8. *A. deceptana* n. sp.; 9. *A. tertiana* n. sp.; 10. *A. buckellana* n. sp.; 11. *A. polluxana* n. sp.; 12. *A. castorana* n. sp.; 13. *A. aspasiana* n. sp.; 14. *A. carolana* n. sp.; 15. *A. vulgana* n. sp.

under a single specific name, the necessity for a study of type material becomes greater and greater; the disadvantages under which a Canadian entomologist labors, where such study involves numerous expensive journeys, become yearly more obvious, and it is with the sole end in view of adding to the type material in the National Collection that the following paper has been prepared. It is possible that in a few instances a named species has been redescribed, as certain identifications have been based on descriptions alone and a study of type material has been impracticable; if such cases should occur, the error may be ascribed to my anxiety to secure as many types as possible for the Ottawa Collection.

SCOPARIINAE.

Scoparia truncatalis sp. n.

Allied to *basalis* Wlk. but with broader and shorter wings and with no olivaceous scaling around the reniform; the genitalia are also distinct. Primaries gray, shaded with smoky; a very short black basal dash; a dark t. a. line, rounded outwards below costa and starting from a small dark costal spot, shaded slightly inwardly with white; included basal space smoky; orbicular occasionally represented by a dark dot close to t. a. line; claviform a dark streak attached to t. a. line; reniform formed by two blackish cusps, making an x-shaped mark; above this some smoky shading but remainder of median space rather pale gray; t. p. line rounded outwardly below costa, then inwardly oblique and minutely dentate, white, shaded on both sides with smoky; terminal space whitish with smoky blotch at centre of outer margin and prominent terminal row of dark spots just inside margin of wing, which appears as a white line. Fringes pale smoky cut by a darker line. Secondaries whitish, slightly smoky outwardly. Expanse 15 mm.

Holotype,—1 ♂, Norway Point, Lake of Bays, Ont. (July 12) (J. McDunnough), in Canadian National Collection.

Paratypes,—6 ♂'s, 1 ♀, same locality and date; 1 ♂, 3 ♀'s, Ottawa, Ont. (July 5, 9, 11) (C. H. Young).

As compared with *basalis* the male claspers are much broader and the aedoeagus contains a bundle of two or three long spines.

PHYCITINAE.

Acrobasis alnella sp. n.

Primaries dark purplish gray with slight ruddy reflections and paler gray shading; t. a. line arising from a triangular dark shade on costa, well outcurved to cell, then straight to inner margin, pale gray, bordered by a dark line; the space between it and the dark basal scale-ridge dull clay color, median space with paler gray shading below costa and two superimposed black discal dots; t. p. line straight below costa, bulging gently opposite cell and finely dentate, whitish, bordered inwardly by a dark line. A dark terminal line. Secondaries dull smoky. On the underside the male is without black markings. Expanse 17-22 mm.

Holotype,—1 ♂, Ottawa, Ont. (July 9) (J. McDunnough), bred from Alder, in Canadian National Collection.

Paratypes,—4 ♂'s, 3 ♀'s from the Ottawa region, bred from Alder on various dates in July.

The species is closely allied to *betulella* but smaller and shows genitalic differences, notably in the much smaller gnathos; the cocoon is oval, much like a miniature *betulella* cocoon. From *rubrifasciella*, also an *Alnus* feeder, it is at once distinguished by the lack of the bright red antemedian band. It may possibly be *normella* Dyar, the food plant of which was not given in the description and the type of which I have not studied.

EUCOSMIDAE.

Exartema Clem.

In working over the material in the Canadian National Collection belonging to this genus (i. e. species with a cylindrical appendage at base of secondaries in the male sex) an examination of the genitalia soon made it apparent that on the one hand there was a group of species very similar in general superficial appearance but differing markedly from each other in genitalia, whilst on the other hand species which could be readily distinguished from each other by maculation and color possessed genitalia so similar that no definite points of distinction could be found in these organs.

The first group centers around *permundanum* Clem.; our determination of this species is based on a study of the descriptions of Clemens and Zeller and agrees with specimens in the collection determined as this species by Kearfott and Busck; a figure of the clasper is given (c. f. fig. 1). As at the present time it is impossible to examine Walker's type specimens the synonymy as given in Dyar's List is accepted. Several apparently unnamed species are herewith described.

Exartema troglodanum sp. n. (Fig. 2).

Maculation very similar to that of *permundanum* but the general impression given is that of a much darker insect due to the dark bands being thickly covered with rather bright brown scales; the pale lines defining these dark areas are also much less evident in this new species than in *permundanum*. Basal dark area slightly sprinkled with light scales, its outer border is outwardly oblique from costa at ¼ to center of wing, then almost perpendicular to inner margin with a slight concavity in the fold. The median band shows very dark shading at costa and the same two projections of the outer border found in *permundanum;* below these the band is completely cut by a narrow line of paler ground color. The anal spot is large and triangular and the oblique subapical dark band is broadly joined to the first dark costal spot. Pale areas with considerable purplish silvery iridescence and cut by a central dark line; fringes pale yellowish, cut at apex and above anal angle with dark scales. Secondaries dark smoky with pale fringes. Expanse 16-18 mm.

Holotype,—1 ♂, Meach Lake, Que. (C. H. Young) (June 17), in Canadian National Collection.

Paratypes,—1 ♂, 2 ♀'s, Ottawa, Ont. (C. H. Young) (June 27, 28), in same Collection.

Exartema furfuranum sp. n. (Fig. 3).

Color and maculation of *permundanum* but slightly more greenish olivaceous and with the pale areas much more strigate with darker lines and dashes; all dark bands very distinctly outlined with pale ochreous. The two outer projections of the median band are very long, the upper one almost touching the oblique subapical band which ends at a point opposite this tooth and does not connect with the dark costal spots. Fringes dusky. Secondaries deep smoky with paler fringes. Expanse 16 mm.

Holotype,—1 ♂, Ottawa, Ont. (C. H. Young) (June 20), in Canadian National Collection.

Paratypes,—1 ♂, 1 ♀, Meach Lake, Que. (C. H. Young) (June 20, 21), in same Collection.

Exartema rusticanum sp. n. (Fig. 4).

Usual type of maculation; pale areas very decidedly silvery-purplish; dark bands suffused with ruddy scales, especially prominent in outer areas (in worn specimens not so noticeable). The two outer projections of median band are short and the lower one quite thick, the space between the two containing a pale ochreous spot; there is also a bluish spot at base of lower tooth enclosed in dark area; the triangular anal spot is generally connected with the oblique subapical band by a fine network of lines, as is also this band with the first costal spot. A thick dark line at base of fringes which are pale, checkered irregularly with black. Secondaries dark smoky. Expanse 15-16 mm.

Holotype,—1 ♂, Onah, Man. (N. Criddle) (July 17), in Canadian National Collection.

Paratypes,—2 ♂'s, 2 ♀'s, Onah, Man. (N. Criddle) (July 17-19), in same Collection.

The genitalia are similar to those of the preceding species but the two species can be readily separated by color and maculation. A ♀ specimen from Trenton, Ont., appears to belong here; it had been identified by Kearfott as *zellerianum* Fern. but Zeller's figure represents quite a different type of maculation and I cannot agree with this determination.

Exartema fraternanum sp. n.

Very similar to preceding species in maculation and genitalia but lacking the ruddy tinges and with pale areas distinctly less silvery, resembling in this respect a small dark form of *permundanum*. The teeth of the median band are less blunt and wider apart than in *rusticanum* and there is no pale area below the inner tooth with the exception of a couple of hair-lines joining the costal and inner portions, this latter being goblet-shaped with short stem resting on inner margin. Oblique subapical band dark, much thickened in upper portion, joined by a fine line to costal spot and also to anal triangular spot. Secondaries dark smoky with pale fringes.

Holotype,—1 ♂, Ottawa, Ont. (July 3) (C. H. Young), in Canadian National Collection.

Exartema bolandanum sp. n. (Fig. 5).

Very similar to *olivaceanum* Fern. and of the same type of genitalia; the general appearance of primaries is more mottled than in *olivaceanum;* the best point of distinction is found in the subterminal area, the oblique band being broader and closer to apex of wing in *bolandanum* with a narrow line of dark scales extending down to anal angle; the apex of the triangular dark spot on inner margin is joined to the center of the oblique band by a narrow dark line and the included pale space above tornus is bisected by another dark line running from the first line to anal angle. Fringes pale at apex and anal angle, dark centrally. Expanse 13 mm.

Holotype,—1 ♂, Ottawa, Ont. (June 10) (C. H. Young).

Exartema versicoloranum Clem.

Exartema versicoloranum Clem. 1860, Proc. Acad. Nat. Sci. Phil., 357.

Sericoris versicoloranum Clem. 1865, Proc. Ent. Soc. Phil., 136.

The original description of this species is very vague and might apply to several species; in his second paper however Clemens states that the species is ordinarily distinguished by the white or yellowish-white costa at the base of wing and the white space toward the hinder margin. There is a single ♂ specimen in the Canadian National Collection from Trenton, Ont. (Aug. 1) which agrees with the above diagnosis, but differs markedly in genitalia from an Ottawa series, captured in June, under the same specific name. As however this latter series fits in excellently with Zeller's description of *appendiceum,* at present listed as a synonym of *versicoloranum* Clem., I propose to use *versicoloranum* Clem. for the species with white costa at base and resurrect *appendiceum* Zell. from the synonymy for the very similar species with dark basal area.

Exartema valdanum sp. n.

Basal and median areas dark olivaceous black-brown, separated by a band of whitish color containing a few dark dots in form of a broken central line; this pale band is upright with margins slightly waved. Median band outwardly with two blunt teeth and an indentation of pale color below inner tooth. The usual dark triangular spot near anal angle and an oblique band running inward from center of outer margin and joined to first costal spot by fine line; a narrow dark area below apex sending hair-lines to costal spots and separated from subapical band by a narrow band of whitish. Remainder of outer area pale, same color as inner band, slightly clouded with smoky. Fringes irregularly checkered black and white. Secondaries dark smoky with pale fringes. Expanse 17 mm.

Holotype,—1 ♂, Ft. Coulonge, Que., (July 7) (S. A. Graham), in Canadian National Collection.

Allotype,—1 ♀, Aylmer, Que. (May 29) (J. McDunnough).

The type of genitalia is that of *permundanum* but the pale bands of primaries rather recall *fasciatanum* Clem.

Exartema nananum sp. n.

Thorax light brown; primaries with usual type of maculation, the dark

areas cinnamon-brown, the pale bands and spots bluish-silvery. Basal area with outer margin bulging outwardly, sprinkled with a few bluish scales in costal half of wing. Antimedian pale band cut by a central brown line. Median brown band with inner margin slightly concave, composed of an upper boot-shaped spot and a lower subquadrate spot joined together narrowly at heel of boot and also near the toe, enclosing a pale bluish spot; there is also a projection on outer margin of the band below costa. The subapical oblique band is thickened in its middle and joined to the first costal spot, the toe of the boot and the anal triangular spot by fine lines, the enclosed areas being of the bluish-silvery color of the antemedian band. Terminal area narrowly brown with a fine bluish line bordering the oblique band outwardly. A dark terminal line. Fringes slightly bluish with dusky apical and median areas. Secondaries smoky with lighter fringes. Expanse 12 mm.

Holotype,—1 ♂, Mer Bleue, Ottawa, Ont. (July 20) (C. H. Young), in Canadian National Collection.

The type of genitalia is that of *permundanum*.

Exartema bicoloranum sp. n.

Primaries cinnamon-brown beneath which towards the base an underlying area of black scaling may be seen with a lens; all maculation very indistinct, consisting of the usual bands and spots in a slightly deeper brown than the general ground color, rather better defined in outer area, where the outer edge of the median band, the anal triangular spot and the oblique subapical band are visible, the latter defined by narrow lines of purplish; a dark terminal line; fringes pale ochreous tinged with smoky. Secondaries pure white, with a smoky terminal border, broadest at costa; fringes pale. Expanse 13 mm.

Holotype,—1 ♂, Barrington Passage, N. S. (July 10) (C. H. Young), in Canadian National Collection.

The type of genitalia is similar to that of *furfuranum* and *rusticanum;* the white secondaries readily distinguish the species from others of the genus.

Exartema submissanum sp. n.

Primaries dull cinnamon-brown with a purplish tinge due to a strong striation of brown scales on a purple ground color; maculation very indistinct, best defined in terminal area, brighter brown than ground-color without purple tinge. Median band with a sharp outward angle below costa, then more or less perpendicular to inner margin, rather narrow; anal triangular spot small, more or less joined to median band; oblique subapical band most distinct of all the maculation, narrow, of even width throughout, joined by a fine line to first costal spot; apex streaked with brown. Dark terminal line; fringes pale ochreous, shaded with smoky. Secondaries whitish hyaline at base shaded with smoky outwardly, forming a more or less diffuse outer dark border. Expanse 16 mm.

Holotype,—1 ♂, Ottawa, Ont. (July 23) (C. H. Young), in Canadian National Collection.

Paratypes,—3 ♂'s, 1 ♀, Ottawa, Ont. (July 17, 23) (C. H. Young), in same collection.

The species resembles somewhat the preceding but is larger with less distinctly white secondaries and the genitalia are of the *permundanum* type. According to Zeller's figure and description it would appear to be fairly close to *zelleranum* Fern. lacking however the prominent tooth of the median band.

Exartema terminanum sp. n. (Fig. 6).

Basal 4/5 of primaries deep purplish-black with a few purple shining striae arising from pale costal spots antemedially indicating the usual pale band. The outer 1/5 of wing is pale ochreous crossed by the blackish subapical band which loses itself in the dark area, is of even width throughout and slightly bent; a few dark streaks at apex and tornus of wing. The usual dark median band is slightly indicated by curved purple striae on its outer edge. Fringes pale ochreous tinged with smoky. Secondaries light smoky, paler in basal area. Expanse 14 mm.

Holotype,—1 ♂, Ottawa, Ont. (July 1), (J. Fletcher), in Canadian National Collection.

Paratypes,—1 ♂, 2 ♀'s, Ottawa, Ont. (July 10, 14, 28) (C. H. Young), in same collection.

This may be merely a form of *concinnanum* Clem. as it has the same type of genitalia. In any case, on account of the striking coloration, it would seem worthy of a name.

Argyroploce capreana Hbn.

There are before me four species belonging to this group and all closely allied. *Capreana* may be best distinguished by a small comma-like white mark jutting in from the white apical area to the outer margin of the dark basal area about the center of the wing. It is represented in the National Collection by specimens from Ottawa, Trenton and Sudbury in Ontario, one male from Nordegg, Alta., and one male from Vancouver, B. C. If identifications made by Mr. Kearfott are correct, *frigidana* Pack. would appear to be a synonym of this species.

The other species appear to be undescribed. I have carefully compared them with existing descriptions of North America species and also figures and descriptions of the allied European species and cannot match them. I therefore offer the following descriptions.

Argyroploce youngana sp. n. (Fig. 7).

Rather larger than *capreana* but very similar in general appearance. Basal 2/3 of primaries dark purplish-brown, blotched with still darker markings; the costal area, however, for about half the length of wing, is shaded with white, enclosing a quadrate dark patch near base of wing. The outer margin of the dark area is sharply and evenly defined, being perpendicular to below cell, then forming a distinct angle and outwardly oblique to inner margin just before tornus. Apical 1/3 white, clouded with purple-gray at apex, with two dots of similar color on costa from which proceed faint wavy subparallel gray shades crossing obliquely to outer margin. Fringes smoky slightly checkered. Secondaries dull smoky with paler fringes. Expanse 19-20 mm.

Holotype,—1 ♂, Meach Lake, Que. (July 20) (C. H. Young), in Canadian National Collection.

Paratypes,—1 ♂, Chelsea, Que. (July 6); 6 ♀'s, Meach Lake (Aug. 5), Ottawa, Ont. (July 4, 6, 11, 25, 28) (C. H. Young).

The male genitalia have the arm of the clasper narrowed for a considerably greater length than is found in *capreana;* there are also differences in the gnathos and the spining of the aedoeagus.

Argyroploce deceptana sp. n. (Fig. 8).

Much smaller than preceding species; evidently allied to the European *sauciana.* Basal 2/3 of primaries brown, slightly sprinkled with white scales forming a more or less evident dash from base through center of wing; a small dark quadrate patch on costa near base and a larger one near outer edge of dark area; several irregular dark blotches in central portion of wing. Outer 1/3 of wing white, the dividing line not very sharply demarcated; a white hook projects into the dark area below cell, leaving a distinct blackish ocellus-like mark, much as in *separatana* Kft., standing out on the margin of the white area; a triangular anal spot is partially separated by pale scaling from the basal dark area. The apex of wing is shaded with brown and directly below this a short blackish oblique subapical band is present, not attaining however to costa. Fringes dusky whitish at anal angle. Secondaries pale smoky, darker outwardly. Expanse 15 mm.

Holotype,—1 ♂, Ottawa, Ont. (June 5) (C. H. Young), in Canadian National Collection.

Paratypes,—2 ♀'s, Meach Lake, Que. (June 17), Ottawa, Ont. (June 24), taken by same collector.

Argyroploce tertiana sp. n. (Fig. 9).

Primaries with basal 2/3 purplish-brown, sprinkled with bright brown and with several darker blotches centrally; the beginning of an antemedial pale band is visible in a patch of whitish scaling on costa, partially obscured by brown dots; outer margin of dark area oblique and rather irregular; outer 1/3 of wing white, considerably obscured by dark shading, much more so than in preceding species; three dark dashes along costa; apex of wing dark, shaded with bright brown which continues downward along outer margin; a dark oblique subapical band, not attaining costa and shaded with light brown scales; the space between this band and the dark basal area is almost completely occupied by a broad grayish shade sprinkled with brown, extending upwards from anal angle to a point opposite cell and broadest at its apex which is truncate; a dark terminal line; fringes dusky. Secondaries smoky, paler basally. Expanse 16 mm.

Holotype,—1 ♂, Ottawa, Ont. (June 25) (C. H. Young), in Canadian National Collection.

Allotype,—1 ♀, Ottawa, Ont. (June 5) (A. Gibson), in same collection.

The ♀ shows more ruddy scaling below apex of wing and the dark basal area is continued along costa to include the first costal dash; the secondaries are also darker. I believe these differences are merely sexual.

Argyroploce buckellana sp. n. (Fig. 10).

Allied to the preceding species, especially the ♀, in type of maculation but distinct in genitalia. Primaries dark brown, shaded with blackish, with inconspicuous whitish antemedian band and outer ¼ of wing dark brown with blackish shading and with a few orange scales on inner margin at base; the outer edge of this area outwardly oblique to beyond cell, then perpendicular to inner margin; white antemedian band heavily sprinkled with brown scaling and not well defined; median broad oblique dark band of even width throughout, outer edge rather irregular in outline and attaining inner margin just before tornus; beyond this band the ground color is white but so heavily shaded with purplish-gray as to leave the white area only distinct as a fine border line to the median band and a paler area at tornus; this pale edging forms a slight white comma-mark on the dark margin of median band opposite cell; three whitish geminate dashes on costa before apex, a dark apical spot and a short curved dark subapical band; a ruddy-brown terminal line; fringes smoky, mixed slightly with brown and white. Secondaries deep smoky with paler fringes cut by a dark basal line. Expanse 15 mm.

Holotype,—1 ♂, Salmon Arm, B.C. (May 28) (W. R. Buckell), in Canadian National Collection.

I take much pleasure in naming the species after the collector, Mr. W. R. Buckell, who has through his careful and painstaking collecting added considerably to our knowledge of British Columbian Lepidoptera.

Argyroploce sordidana sp. n.

Size and general maculation of *glitranana* Kft. but of a much darker appearance, due to the fact that the pale areas between the dark bands are only slightly lighter in color than the bands themselves. Basal area of primaries black, overlaid heavily with brown and ochreous scaling and interrupted by several bluish-silvery dots; median band similar in color to basal area, in shape much as in *glitranana;* the paler space between basal area and median band is defined by two subparallel bands of bluish-silvery spots the included area being scaled with brown, without the underlying blackish color. A triangular anal spot and broad subapical band similar in color to median band, all their edges defined by silvery scaling; remaining areas similar to antemedian band in color. A row of dark spots along costa bordered with pale ochreous and a dark terminal line. Fringes deep smoky, slightly paler below apex. Secondaries deep smoky, almost black, with pale fringes. Expanse 16 mm.

Holotype,—1 ♂, Coliseum Mt., Nordegg, Alta., 6500 feet. (July 12) (J. McDunnough), in Canadian National Collection.

Paratypes,—3 ♂'s from same locality (July 7, 12, 18).

Argyroploce thallasana sp. n.

Allied in size and structure to *duplex* Wlshm. Primaries with basal two thirds dull purplish washed with olivaceous-brown which color forms a faint basal patch and is most prominent as a large irregular patch on inner half of wing, covering the area between anal angle and middle of inner margin. Outer half of wing olivaceous with small brown apical spot and slight brown shading along outer margin. Costa beyond middle with four pairs of pale ochreous

dashes separated by black and giving rise to irregular silvery-purple lines; from the first pair arise two lines very oblique outwardly below costa then broadening and irregularly perpendicular to inner margin, cutting through the dark patch and attaining margin near anal angle; oblique streaks from the second and third pairs of dashes coalesce to form a purple stripe which curves and runs subparallel to outer margin, bifurcating above anal angle; from outer of the last pair of dashes a short purple streak extends to outer margin below apex defining the brown apical spot. Some pale terminal dots, most evident above anal angle. Fringes mixed pale and smoky with dark basal line. Secondaries smoky with paler fringes. Expanse 22 mm.

Holotype,—1 ♂, Aweme, Man. (June 17) (N. Criddle), in Canadian National Collection.

Paratypes,—2 ♀'s, Aweme, Man. (June 25); Lauder, Man. (Aug. 1), by same collector.

Argyroploce aspasiana sp. n. (Fig. 13).

Allied to *instrutana* Clem. in color and maculation but much smaller. Base of primaries dark olivaceous-brown with considerable white scaling at extreme base; a whitish transverse antemedian band cut by a brown central hair-line; the band is slightly excurved below costa and the edges are rather irregular; median dark band composed of ruddy-brown scaling on a dark ground-color giving a decided olivaceous-brown tinge; the outer edge is strongly outwardly oblique from costa to centre of wing where it forms a prominent projection and then bends inward to inner margin, the width of band in centre of wing being twice the width of same at costa and inner margin; the apex of the projection is scaled with black; a long narrow triangular brown spot before anal angle and a broad similarly colored oblique subapical band extending from costa to below middle of outer margin and containing a dull leaden patch opposite the cell; intervening pale areas are silvery with scattered white scaling; apex of wing brown, cut by a silvery streak, and with three geminate white streaks at apical portion of costa and a pale line below apex on outer margin. Fringes dusky, slightly cut by brown. Secondaries smoky with paler fringes. Expanse 11 mm.

Holotype,—1 ♂, Mer Bleue, Ottawa, Ont. (July 3) (C. H. Young), in Canadian National Collection.

Paratypes,—1 ♂, 2 ♀'s, same locality and collector, (July 2-3).

The male genitalia are so different as to almost suggest another generic reference but I can see no other structural differences to warrant this at present. The uncus and tegumen are strongly chitinized and the former is long and pointed; the gnathos is well developed but the socii are lacking.

A study of genitalia of series before me from Ottawa, Ont., and Nordegg, Alta., shows that there are several quite distinct species in the difficult *campestrana* group which as yet are unnamed. One of these may possibly prove to be *glaciana* Moesch. but as none of them fits very closely the description and figure of this species (1860, Wien. ent. Monatsschr. IV, 380) and as it is impossible at the present time to get information concerning the genitalia of the type specimen, I venture to propose names for all of these species as follows:—

Argyroploce castorana n. sp. (Fig. 12).

Thorax, palpi, head and abdomen black-brown; primaries black-brown crossed by a white antemedian band and with the apical ½ more or less of the same color. Basal area deep black-brown, the outer edge rather evenly convex with a slight outward projection below cell; white antemedian band with outer edge only slightly irregular and with faint dark central hair-line; median band broad, dark black-brown, slightly suffused with purplish scaling, broadest on inner margin where it is extended to include the triangular anal patch, the outer edge being irregularly concave from costa to above vein 2 and then perpendicular to inner margin just before tornus; on this outer edge in the central area of wing a round blackish spot is more or less distinctly visible, defined on its upper inner edge by a white dot; subterminal area white with a few dark striations and with two black costal spots, separated by white areas through which a fine black hair-line runs; opposite cell is an irregular dark shade which at times connects with the terminal dark area and also with the median band above tornus; apex and outer margin of wing rather broadly black-brown, narrowing to just above anal angle. Fringes smoky, paler at anal angle, with a darker basal line. Secondaries pale smoky with paler fringes which show a dark basal line. Expanse 17 mm.

Holotype,—1 ♂, Nordegg, Alta. (July 7) (J. McDunnough), in Canadian National Collection.

Paratypes,—9 ♂'s, Nordegg, Alta. (June 24, 30, July 4, 5, 7) (J. McDunnough), in same collection.

There is also a series before me from Ottawa, Ont., slightly smaller in size than the Nordegg specimen but with same type of genitalia. The species is best separated from *campestrana* by the fact that *two* instead of *three* postmedian costal spots are present; in this feature it approaches *fuscalbana* Zell., which, however, besides differing in genitalia, has a brighter and more contrasted type of coloration.

Argyroploce polluxana n. sp. (Fig. 11).

Very similar to preceding species but with white areas more silvery-white, giving a more contrasted tone to the coloration. The antemedian white band sends a short rounded projection in the cell into the dark median area, and opposite this is a similar projection from the pale subterminal area; the triangular spot before tornus is not so entirely merged into the median area but is slightly defined inwardly by pale purplish shading; the subapical oblique streak is also partially separated from the dark apical area by paler purplish shading and at times bends backward towards apex of triangular patch; there are three dark costal spots, and the white subterminal area is more striated and blotched with dark color than in *castorana*. Expanse 18-19 mm.

Holotype,—1 ♂, Nordegg, Alta. (July 5) (J. McDunnough), in Canadian National Collection.

Paratypes,—5 ♂'s, same locality and collector (July 7, 14, 20).

The species were taken along with the preceding in a mixed spruce and tamarack swamp. There are a number of specimens from Ottawa, Ont., in the Canadian National Collection which show the same type of maculation and genitalia as the type specimens.

Argyroploce carolana n. sp. (Fig. 14).

Very similar in maculation to the two preceding species but smaller and with a decided olivaceous tinge to the dark areas. In contradistinction to the allied forms the patagia are white with the exception of a dark patch at base, the thorax is also crossed by white bands; on the primaries the outer edge of the basal dark area tends to become irregular, showing (in two specimens) slight rounded excavations in cell and on submedian fold; the outer edge of the dark median band shows a downward indentation of white color at the apex of the triangular patch, which patch is joined to the median area; the subterminal white band is narrow, the whole terminal area being broadly (except at costa and anal angle) suffused with olivaceous brown; there are two olive-brown costal spots which may or may not be connected by hair-lines with the dark terminal area. Expanse 14 mm.

Holotype,—1 ♂, Ottawa, Ont. (June 21) (C. H. Young), in Canadian National Collection.

Paratypes,—1 ♂, same locality and collector (June 24); 1 ♀, Trenton, Ont. (June 11) (J. D. Evans) in same collection.

The type of genitalia is remarkably distinct.

Argyroploce vulgana n. sp. (Fig. 15).

Similar in type of maculation to the three preceding species but in the male sex with the pale areas much duller and largely suffused with dark striations. Basal area and median band dull olivaceous-brown, the latter in shape similar to that of *castorana* and with a fairly evident blackish dot at end of cell; antemedian pale band often very indistinct and at times not attaining inner margin; subterminal pale area reticulate with olive-brown and with two dark costal spots; the dark color of apex and terminal area forms roughly a triangular blotch of which the outer margin is the base; at times this area can be differentiated into an apical blotch and a subapical oblique streak, due to slightly paler scaling between the two component parts; fringes dark at apex, mixed pale and smoky in other areas. Secondaries dull smoky.

In the female the white areas are quite prominent and sharply defined. Expanse, ♂, 15 mm., ♀, 14 mm.

Holotype,—1 ♂, Nordegg, Alta. (July 9) (J. McDunnough), in Canadian National Collection.

Allotype,—1 ♀, Nordegg, Alta. (July 11) (J. McDunnough), in same collection.

Paratypes,—12 ♂'s, 1 ♀, same locality and collector, taken on various dates from June 27 to July 14.

The species was quite common in the muskeg around bushes of dwarf birch on which it probably feeds. The type of genitalia is remarkably distinct.

Argyroploce nordeggana n. sp.

Primaries olivaceous-brown, banded with silvery-white. Basal area dark, the outer edge forming a strong truncate projection in the cell; antemedian band broad, silvery-white with three dark costal dots from central of which a wavy olivaceous line arises, bisecting the band and tending to connect by fine lines with the dark areas on both sides, thus dividing the white area into numerous small

quadrate patches. Median band dark, upright, rather narrower than usual, almost bisected by projections of the surrounding pale area just above submedian fold, the upper portion with two blunt tooth-like projections on its outer margin; this dark area is followed by a subterminal silvery band with central dark line arising from costal spot and with same tendency to divide up into small rectangular patches as in the antemedian band; the pale band bifurcates above anal angle and encloses a large ovate dark spot; the remainder of the wing is occupied by a net-work of olive-brown lines and bands enclosing small patches of leaden-colored scales and containing two geminate white dashes on costa; fringes mixed smoky and white with dark basal line. Secondaries dull smoky. Expanse 20 mm.

Holotype,—1 ♂, Nordegg, Alta. (July 14) (J. McDunnough), in Canadian National Collection.

Paratype,—1 ♂, same locality and collector (July 18).

A female specimen which we are inclined to associate with this species is whiter, especially in the apical area; where the dark bands are reduced and the leaden-colored scales replaced by white ones.

A NEW LITHOBIID OF THE GENUS PAOBIUS.

BY RALPH V. CHAMBERLIN,

Cambridge, Mass.

Through Dr. J. McDunnough I have received for identification a specimen of a diplopod and two specimens of a chilopod collected in Alberta, Canada, by Mr. N. B. Sanson of Banff. The diplopod is apparently a not fully mature male *Parajulus hewitti* Chamberlin, a species described originally from specimens taken by Dr. Hewitt at Agassiz, B.C. The present specimen is much darker in color than the type, with the legs nearly chestnut. The cauda is very similar though somewhat shorter and the lateral striae are more pronounced. It was taken nearing Bryant Creek Cabin, Sept. 22, 1921.

The chilopods represent a new species in the genus *Paobius* of the family Lithobiidae. In the key to species given by the writer in his review of the genus* the present species runs out to *P. orophilus* Chamberlin, a British Columbian species from which, however, it is clearly distinct. The key may be modified to take in the new form as follows:

a. Dorsal spines of anal legs 1, 0, 3, 0, 0 or 1, 0, 2, 0, 0.

b. None of the posterior coxae laterally armed; ventral spines of thirteenth legs 0, 1, 3, 3, 1; third joint of first ten or more pairs of legs with but two dorsal spines.....*P. vagrans* Chamb.

b.[1] Last two pairs of coxae laterally armed. Ventral spines of thirteenth legs 0, 1, 2, 3, 2 or 0, 0, 2, 3, 2; third joint of all legs with three dorsal spines.....*P. borcus* Chamb.

a.[1] Dorsal spines of anal legs 1, 0, 3, 1, 0.

b. Dorsal spines of penult legs 1, 0, 3, 1, 1 .....*P. albertanus*, sp. nov.

b.[1] Dorsal spines of penult legs 1, 0, 3, 1, 0.

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*Bull. Mus. Comp. Zool., 1916, 57, p. 162.

c. Fifth joint of sixth to ninth pairs of legs with but one ventral spine; head equal in length and breadth; claw of genital forceps of female tripartite.....*P. columbiensis* Chamb.

c.[1] Fifth joint of sixth to thirteenth pairs of legs with two ventral spines; head wider than long; claw of genital forceps of female bipartite .....*P. orophilus* Chamb.

Paobius albertanus sp. nov.

Dorsum brown of a slightly chestnut cast, the head similar, typically with a darker spot on posterior half. Head slightly wider than long. Ocelli in three series, nine to twelve in number. Antennae rather long; articles all relatively long, the last one equal in length to the two preceding ones taken together.

Prosternum and its teeth much as in *P. orophilus;* the distance between chitinous spots similarly four times as long as the dental line.

Ventral spines of penult legs 0, 1, 3, 3, 2; dorsal spines, 1, 0, 3, 1, 1; claws three of which the anterior is straight and spine-like. Ventral spines of anal legs 0, 1, 3, 3, 1; dorsal spines 1, 0, 3, 1, 0; claw single. Last four pairs of coxae laterally armed.

Claw of female genital forceps distinctly tripartite; basal spines proportionately broad as in *P. vagrans*, the inner on each side smaller than the outer. Length of male, 9 mm.; of female, 11 mm.

Locality.—Canada: Alberta. One male and one female taken by N. B. Sanson on "the Spring Lakes trip" April 25 and 26, 1918.

Differs from all the previously known species in the spining of the penult legs.

NOTE ON TYPES OF *ERNESTIA* R. D. (DIPTERA)

BY J. D. TOTHILL.

Entomological Branch, Ottawa, Ont.

The type of *Ernestia nigrocornea* Tothill is in the California Academy of Sciences and not in the Canadian National Collection as stated by the author in Canadian Entomologist, 1921, p. 228.

Great Falls, Va., is the type locality of *E. platycarina* Tothill (l. c. p. 271) and the number of the type is 24357 and not 24359.

Lillooet, B. C., is the type locality of *E. sulcocarina* Tothill (l. c. p. 272). Bear Lake, B. C., is the type locality of *E. bicarina* Tothill (l. c. p. 272).

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POPULAR AND PRACTICAL ENTOMOLOGY

Insect Food of the Black Bear (Ursus Americanus).

BY N. K. BIGELOW,

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During the summer of 1921 the writer of this article was studying the Plankton of Lake Nipigon, Ont., and collecting insects during his spare time. While searching for insects in the bush many opportunities were presented for observing the habits of wild life under natural conditions. Not the least interesting of these observations were those concerning the Black Bear (*Ursus americanus*).

On the afternoon of August 22 Duncan Bell, a missionary to the Ojibway Indians of that vicinity, and myself saw a black bear in the bush about one mile south of Grand Bay. The animal was a small one, only one-third grown, and was walking along a moose trail at a leisurely pace. We walked along the trail in the direction opposite to that taken by the bear and found that the creature had been making a meal off a nest of yellow-jackets only a few minutes previously. Within a very few feet of the spot where we saw the bear we found the evidences of his repast. The animal had eaten paper, larvae and adults as well. All that was left was a hole in the ground beside the trail with about half a dozen very angry hornets flying around it. Within fifty feet of this we found where another nest of these insects had been destroyed. In both instances a few of the hornets were still flying about. They proved upon capture to be *Vespula diabolica* De Saussure.

In this same vicinity we found the dung of this or a similar sized bear. This material was apparently a day or two old and was composed of the remains of hundreds of adult hornets some of which were in a good enough state of preservation to be readily identified. Both *Vespula diabolica* De Saussure and *Vespula consobrina* De Saussure were present.

At this point it may be well to notice what others have to say concerning the bears' fondness for hornets. Lockwood[1] tells us in the Riverside Natural History that "Bears like the larvae of wasps' nests. Such a nest in the ground they will scratch up, digging with much rapidity, but often having to stop from the stings of the enraged insects. They will snarl and roll on the ground and go at it again. Although the punishment is severe Bruin keeps at it until he has secured his hard earned prize."

Ernest Thompson Seton[2] says that "A pleasing variation of late summer foods is found in the nests of several species of wasps as well as of wild bees."

[1]Samuel Lockwood, The Riverside Natural History, Vol. V, p. 378.
[2]Ernest Thompson Seton, Life Histories of Northern Animals, Vol. II, p. 1082, 1083.

He also states that "According to Merriam the bear digs out the nests of the yellow-jackets devouring both the wasps themselves and the comb containing their honey and grubs."

Bears are very fond of tearing decayed stumps and logs to pieces in search of beetle larvae and ants' nests. Remains of their handiwork were found almost every day in the bush. The thoroughness of their search is attested by the minute fragments into which the wood is clawed. The bears' fondness for ants is well known to the Indians, trappers and fishermen of Lake Nipigon.

Professor B. A. Bensley of the University of Toronto has made an interesting observation concerning the bears' fondness for ants. He opened the stomach of a small bear which he had killed near Go Home River, Georgian Bay, about the middle of July, 1911, and found it to contain at least a quart of ant pupae. He says that the pupae alone constituted by far the greater part of the material although a few adult ants and small bits of wood were present. This was at a time when the animal could have secured plenty of blueberries if it had chosen to do so.

Ernest Thompson Seton[2] gives us the following interesting information as to the black bears' fondness for ants. "Throughout the summer all kinds of insects and especially ants are important bear food."

"In the sand hills about Carbury, in the woods about Lake Winnipegosis, throughout the Bitter root mountains of Idaho and in the ranges of the upper Yellowstone as well as in the Rockies of the Colorado and the Low Laurentians of the Ottawa I have found that ants' nests furnished the bear with an important article of food."

"Following the trail of one I have found that it invariably turned over every log and flat stone that it came to and ripped open every rotten log and stump in its search for insects, the greater part of which must have been ants. Among the Bitter root mountains I have in a single day passed hundreds of these demolished logs and stumps."

"In the Adirondacks according to Merriam the black bear delights in tearing up old logs and stumps in search of the ants that make their homes in such situations."

"While fishing in the North Bay of Big Moose Lake during the summer 1881 Mr. Harry Burel Miller of New York City heard a bear tearing down an old stump that stood on a point in the bay. His guide, Richard Crego, noiselessly paddled him to the spot and he killed the bear with one ball from his rifle. Its stomach contained about a quart of ants and their eggs."

Stone and Cram,[3] after telling of the bears' fondness for berries of many kinds, particularly blueberries, says that "They also dig for roots and bugs and catch grasshopers and crickets in the grass. When there is plenty of such to be had they will, it is said, pass the newly killed carcass of a deer or sheep without noticing it."

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[3]Stone and Cram, American Animals, p. 258.

A REVISION OF THE NORTH AMERICAN SPECIES OF MORDELLA RELATED TO M. MELAENA. (COLEOPTERA).

BY EMIL LILJEBLAD,
Chicago, Illinois.

In the course of the writer's detailed study of the American Mordellidae, in which he has had the opportunity of examining many hundreds of specimens of the genus *Mordella,* it has become apparent that the species comprising the *melaena* group are insufficiently distinguished by the brief diagnoses heretofore published. This is notably true of *M. melaena* and *M. atrata* (*"scutellaris"*), which the writer has found more or less confused in nearly every collection examined.

Five species of this group are recognized from eastern North America, namely *quadripunctata, melaena, atrata, lecontei,* and a new species, *M. knulli,* from Florida. Of the five characteristically western species here discussed, four are described as new, and the fifth, *M. signata,* is recorded for the first time from the United States.

1. *Mordella signata* Champion.[1]

The two specimens at hand, identified as of this species, are the first to be recorded north of Middle America. Both were taken in New Mexico, one in Socorro County, by Mr. W. J. Gerhard (deposited in the Field Museum of Natural History), the other at Del Labo (in the writer's collection). These two differ slightly from the types as originally described, but as Champion cites two "variations," one from Mexico, it seems probable that these slight variations in coloration are not of specific significance.

This is a large and well-marked species.

Form cuneate. Head black, with cinereous pubescence; prothorax black, with yellowish cinereous pubescence becoming denser on the sides; elytra with the ground color ferruginous, darker toward the apex, marked with a rather broad oblique line from the humeral angle downward one-third length of elytra to near the suture, then forward along the suture to base, and also with an equally broad transversely lunate mark on the disc beyond the middle elytra, with yellowish-cinereous pubescence. Anal style short, bluntly rounded at apex. Length, 8 mm. to end of elytra, 10 mm. to end of anal style.

2. *Mordella quadripunctata* Say.

This, one of our largest species, is rather rarely found in collections. The writer, however, has been able to examine specimens from many localities—Maine, Canada, Virginia, West Virginia, Iowa, Kansas and Colorado. In some specimens, particularly males, the subsutural spots are but faintly indicated. The presence of the two pair of spots, however, best distinguishes this form from *melaena* and *atrata;* it is, furthermore, more robust and usually longer.

Body cuneiform, robust. Color black, entirely covered with sericeous-brownish-cinereous pubescence, more coarsely on the head and thorax than on the elytra; scutellum with silvery-white pubescence; elytra each with two cinereous-argenteous spots, rather beyond the middle, the larger exterior and somewhat linear, the smaller one obsolescent, subsutural, near the base; lower

[1]Biol. Cent. Am., IV, 2, 1891, p. 276.

parts with argenteous pubescence at the sides of the abdominal segments. Head minutely punctured. Last joint of the maxillary palpi scalene-triangular, the inner side a little longer than the apical. Antennae short, reaching middle of thorax; the four first joints small; the fifth to eleventh clavate; third and fourth joints about equal in length; fifth a little longer than the sixth and nearly twice as wide at apex; sixth to tenth about equal in length, clavate, forming an elongated club; eleventh one-third longer than the tenth, tapering to apex. Eyes moderately large, finely granulated. Prothorax one-third wider than long, very little broader than the elytra at base, evenly rounded and converging to apex, the hind angles obtuse; its surface finely punctured; base of prothorax broadly rounded in front of the triangular scutellum. Elytra more coarsely punctured, with two faintly indicated costae extending from base to slightly beyond the middle. Anal style short, stout, truncate at tip. The inner edges of the femora of the anterior legs bear long setae in the male, only fine pubescence in the female. Length to end of the elytra, 6-7 mm.; to tip of the anal style, 7-8 mm.

3. *Mordella melaena* Germar.[2]

Mordella melaena is also one of our rarer species, being usually found singly. Specimens have been seen by the writer from Canada, Maine, Massachusetts, New York, Virginia, Michigan, Illinois and Iowa; it has been recorded further from Pennsylvania, Georgia, Tennessee, Ohio and Colorado. This species appears most closely allied to *M. quadripunctata*, but may readily be distinguished from it, as indicated above in the account of that form. Care must be taken to avoid confusion of this species with *M. grandis*, which it closely resembles; in that species however, the antennae are much longer, more serrate, and less clavate, and the suture has more or less silvery pubescence. The same characters also differentiate *melaena* from two smaller western species, *albosuturalis* and *hubbsi*. The best character by which *melaena* may be separated from *atrata* is the form of the antennae, which are more clavate, the outer joints being more dilated and compact, rather than serrate; further, the scutellum is more sharply triangular, and the anal style is always short and blunt at the tip, not long and slender.

Form robust cuneiform. Color black, the upper surface entirely covered with fine sericeous-brownish-cinereous pubescence (nearly black in some specimens); base of the anal style with cinereous pubescence; lower parts black, with cinereous-argenteous pubescence at the sides of the abdominal segments. Head comparatively large, minutely punctured. Last joint of the maxillary palpi scalene-triangular, more rounded on the inner angle in the female than in the male. Eyes moderately large, finely granulated, rounded in male, more oval in the female. Antennae with first to fourth joints slender; fifth to eleventh strongly serrate, or nearly clavate, forming an elongated club; third joint a little longer than the fourth, which is a little the broader at apex; fifth one-fourth longer than the sixth; sixth to tenth equal in length; eleventh longer than the tenth, triangular, rounded on the inner and apical angles. Prothorax one-third wider than long, rather finely punctate, widest little before the base, evenly

[2]Ins. Spec. Novae, Halle, XXIV, 1824, p. 169.

rounded and converging to apex; its base at middle, in front of the triangular scutellum, broadly rounded. Elytra a little narrower at base than thorax, the sides at middle slightly sinuate, and tapering to apex. Anal style short, and rounded at tip. Length to end of the elytra 5-6.5 mm., to tip of the anal style 6-7.5 mm.

4. *Mordella atrata* Melsheimer.

This is the species which has ordinarily been named *Mordella scutellaris*. But since Fabricius[3] states in the original description of *scutellaris* that the head and thorax are ferruginous, or rusty-red (*Caput et thorax ferrugineo paullo nitidula*) and the elytra black, and gives as the type-locality South America, whereas in the present North American species the color is wholly black, with gray or brownish pubescence, the writer can not agree in regarding as available the name *scutellaris*. The oldest tenable name for the North American species here discussed appears to be *Mordella atrata*[4] for it best agrees with Melsheimer's original account of *atrata*. Numerous specimens have been examined from Canada, Maine, Connecticut, Pennsylvania, Vermont, Massachusetts, New York, New Jersey, Maryland, North Carolina, Colorado, Florida, Tennessee, Michigan, Ohio, Indiana, Illinois, and Iowa.

Body cuneiform, more robust in female than male. Color black; the pubescence of the upper surfaces brownish or very slightly cinereous; of the scutellum cinereous; of the lower parts brownish, sometimes nearly black; sides and anterior margin of the abdominal segments and base of the anal style with sericeous-cinereous hairs. Last joint of the maxillary palpi scalene-triangular in the male, the inner angle rounded in the female. Antennae with joints one to four slender; fifth to tenth serrate; third joint a little longer than the fourth; the fifth, triangular, one-third longer than the third and twice as broad at apex; sixth, one-third shorter than the fifth; seventh to tenth of uniform width, serrate, about as broad as long; eleventh constantly very little longer than the tenth and rounded on inner side. Eyes moderately large, and rounded (particularly in males). Prothorax a little broader than the elytra at base, widest little before the base, then evenly rounded to apex. Scutellum broadly rounded at tip. Anal style rather long, gradually pointed and about one-third longer than thorax. In some specimens from Maine and Massachusetts the anal style is a little shorter and broader at base, tapering abruptly to the middle, then maintaining its width to the apex. Length to end of the elytra 3.5-4.5 mm., to end of the anal style 5.5-6.5 mm.

5. *Mordella lecontei* Sciki.[5]

This apparently valid species has passed currently, under the preoccupied name of *M. irrorata* LeConte[6], as a synonym of *Mordella "scutellaris"* (=*atrata*). It differs markedly from that species, to which it is doubtless closely related, in color. The head and thorax are rather closely covered with black and brownish or grayish brown pubescence, the elytra with black pubescence, sparing-

[3]Syst. Eleuth. II, 1801, p. 123.
[4]Proc. Acad. Nat. Sc. Phila. II, 1846, p. 313.
[5]Junk, Col. Cat. pars 63, 1915, p. 23.
[6]Proc. Acad. Nat. Sci. Phila., XIV, 1862, p. 46. Trost, Kleine Beytr. 1801, p. 27. Sturm, Cat. 1843, p. 170.

ly but conspicuously sprinkled with single shining cinereous, or sometimes brown, hairs. This species appears to be particularly abundant in Pennsylvania and Maryland. Other specimens have been examined from Massachusetts, Maine, Georgia, West Virginia, Ohio, Indiana, Illinois, Wisconsin, Iowa, North Carolina and Texas.

Body cuneate. Head and thorax rather closely covered with black and brownish or grayish-brown pubescence. Elytra with black pubescence, sparingly sprinkled with single shining-cinereous, or sometimes brown, hairs. Otherwise the species resembles *Mordella atrata*.

6. **Mordella albosuturalis**, sp. nov.

This species somewhat resembles *Mordella atrata*, from which it differs in having silvery pubescence along the base and suture of the elytra, and the outer joints of the antennae slightly tapering to apex. It seems only to occur in the western States. It has been taken on flowers of *Heteromela arbutifolia* and several composites.

Body cuneiform, the male usually narrower than the female. Color black, with fine reddish brown pubescence; basal margin of thorax and elytra, the scutellum and elytral suture with argenteous pubescence; under-parts with cinereous pubescence, most dense on the sides and anterior margins of the ventral segments. Last joint of the maxillary palpi scalene triangular in the male, the inner angle more rounded in the female. Antennae with joints one to four slender; the fifth to tenth joints serrate; the third and fourth equal in length, the fourth the widest; fifth about equal in length to the fourth, but one-third broader at apex, with sides straight; sixth to tenth serrate, with inner sides rounded, the sixth broadest; those following diminishing slightly in width to the tenth; eleventh joint one-third longer than the tenth, more oval in shape. Eyes elongate-rounded or egg-shaped, sinuate on the upper side near the antennal cavity in the male (this sinuation nearly obsolete in the female). Prothorax very little wider than the elytra, broadest near the base, then evenly rounded to apex, its base in front of scutellum broadly rounded. Scutellum triangular, rounded at apex, in the male usually a little narrower than in the female; anal style long, gradually tapering in the male, wider and more abruptly tapering to middle in the female. Length to end of elytra 4-5 mm., to tip of anal style 5.5-6 mm.

Several hundred specimens have been examined from California, and some from Oregon, Nevada, Idaho, Montana and North Dakota. The male holotype and female allotype is from Callistoga, near Mt. St. Helena, California, collected on July 14, by C. L. Hubbs. Paratypes were collected by Mr. Hubbs at the type locality, and at the following other localities, all in California; Mt. Diablo, July 18; Blue Lakes, July 12; Carmel, June 18; Jamul, San Diego County, June 10, and Healdsburg, July 10. Other paratypes from California are as follows: Tule River, July 30 (F. S. Daggett); Mariposa Co., June 2-17 (F. W. Nunenmacher); Paradise Valley, August 15 (J. C. Bradley); Paradise Valley, Kings River, July 15 (R. L. Beardsley); Sugar Pine, Madera Co., August 24-31 (J. C. Bradley); Hockett Meadow to Sequoia National Park, July 25; Los

Gatos Canyon, Fresno Co., June 6-8 (J. C. Bradley); Felton, September 6 (J. C. Bradley); Switzers Trail, St. Gabriel Mt., July 10-11 (Fordyce Grinnell, jr.); Camp Baldy, Los Angeles Co., July 28 (L. L. Muckmore); Mt. Lowe, June; Tulare Co., July 30; Raymond, May; Palmas Spring, May 29 (C. A. Frost, collection); Giant Forest, Sequoia National Park, July 21-26 (J. C. Bradley); Sherwood, Mendocino Co., July 1 (Cornell University Collection). Still other paratypes are from Josephine Co., Oregon (June 11, F. W. Nunenmacher); Esmaralda Co., Nevada (June 29, F. W. Nunenmacher); Troy, Idaho, (August 16, Wm. Mann); Glen, Montana, (C. C. Adams); and Bottineau, North Dakota, (August 1, T. H. Hubbell).

7. **Mordella hubbsi,** sp. nov.

This species differs from the other black forms of the genus in the ferruginous color of the femora of the posterior and middle legs, and can easily be distinguished by this character. All of the known specimens have come from California.

Cuneiform, especially in the male. Color iridescent black; head and thorax with sericeous-cinereous pubescence; elytra with fine reddish-brown pubescence; basal margin of thorax, scutellum and elytral suture with argenteous pubescence; under-parts with cinereous pubescence, becoming more silvery at the sides of mesosternum and abdominal segments; mouth-parts and femora of the anterior and middle legs ferruginous to near the knee; antennae dull red at base; last joint of the maxillary palpi scalene-triangular in male, more rounded on the inner angle in the female. Antennae with joints one to four narrow; the fifth to tenth serrate; third joint one-third longer than the fourth; fifth to tenth, as wide as long, the fifth broadest, the sixth to tenth slightly decreasing in width; eleventh little longer than the tenth, oval. Eyes rather large, rounded and sinuate in front in the male, more oval or egg-shaped, with scarcely any sinuation in the female. Prothorax much wider than the elytra at base, widest basally and evenly rounded, converging to apex; its base in front of scutellum broadly rounded. Scutellum triangular, rounded at tip. Anal style long, blunt at tip, about one half as long as the elytra. Length to end of the elytra, 3.5-4.5 mm.; to tip of the anal style 5-6 mm.

Forty-five specimens examined. The male holotype and female allotype, from Carmel, California, were collected on June 18, by C. L. Hubbs. Paratypes are from same place, and from Switzer's Trail, St. Gabriel Mt., California (June 10-July 14, Fordyce Grinnell, jr.); Tulare Co., California (July 30, C. A. Frost); Long Canyon, California, June 3; Mariposa Co., California (June 5-17, F. W. Nunenmacher); Paradise Valley, Kings River, California (July 15-18, R. L. Beardsley); Kenworthy, California (June 8, C. A. Frost); Sherwood, Mendocino Co., California (July 1, Cornell University collection); Three Rivers, Giant Forest, Tulare Co., California (July 16, J. C. Bradley); Coalinga, Fresno Co., California (June 1-3, J. C. Bradley); Camp Baldy, Los Angeles Co., California (July 28, L. L. Muckmore); Los Gatos Canyon, Fresno Co., California (June 6-8, J. C. Bradley); Raymond, California (May), and St. Gabriel Mt., California (June 5, C. A. Frost, collection).

This species I dedicate to my friend, Carl L. Hubbs, from whom I have received many rare specimens and other assistance, and I hope may be considered a valid species for all time.

8. **Mordella grandis,** sp. nov.

This species might readily be confused with *Mordella melaena,* on account of its size and general appearance. It can best be separated from that species by the form of the antenna, which is longer, more narrow (not clavate), and slightly tapering to apex from the sixth joint, and by the silvery sutural line, and the longer and more narrow anal style. It is also closely allied to *albosuturalis,* but is more robust, the antennae are longer, and the scutellum is more triangular.

A rather large species, of cuneate form. Color black; pubescence of the upper surfaces very fine, sericeous black, with cinereous or brownish hairs intermixed; scutellum and elytral suture with argenteous pubescence; lower parts cinereous, the sides of breast and abdominal segments more strongly argenteous pubescent. Last joint of the maxillary palpi scalene-triangular in male, more rounded on inner angle in the female. Antennae with joints one to four narrow, the fifth to tenth serrate; the third slightly longer than the fourth, which is a little wider at apex; fifth to tenth, each a little longer than broad, the sixth widest; the following joints slightly diminishing in width to the tenth; eleventh longer than the tenth, oval in shape in the male (in the female the fifth joint is a little longer than the sixth, the sixth to tenth are about as wide as long). Eyes in male large, rounded, sinuate in front; in the female, more oval in shape, and less sinuate. Prothorax wider than long, considerably wider than the elytra at base, widest near the base, and evenly rounded to apex, hind angles subacute, the base in front of scutellum broadly rounded. Scutellum large and triangular, more pointed in female than the male. Anal style as long as the thorax, truncate at tip. Length to end of the elytra 4-5.5 mm.; to tip of the anal style 6-7 mm.

Eighteen specimens examined from California and Oregon. The male holotype and female allotype are from Mariposa County, collected on June 5, by F. W. Nunenmacher. The paratypes are from same place, and from Tulare Co., California (July 30, C. A. Frost); Long Canyon (June 3); Los Gatos Canyon, Fresno Co., California (June 6-8, J. C. Bradley); Sherwood, Mendocino Co., California (July 1, Cornell University collection); Camp Baldy, Los Angeles Co., California (July 28, L. L. Muckmore); Paradise Pk., Kings River, California (July 18, R. L. Beardley); Sonoma Co., California (Cornell University); Kaweah, California (R. Hopping); and Pendleton, Oregon.

9. **Mordella brevistylis,** sp. nov.

This species somewhat resembles *Mordella atrata,* but is readily distinguishable by its more elongate form and the shorter, blunt anal style.

Form subcuneiform. Color black; both upper and lower surface with black or dark reddish-brown pubescence; sides of breast, and first and second abdominal segments at sides with cinereous pubescence. Last joint of maxillary palpi scalene-triangular. Antennae short, reaching to about middle

of thorax. Antennal joints one to four narrow, the fifth to tenth segments serrate; the third and fourth equal in length, the fourth widest; sixth to tenth about as wide as long, nearly alike in shape; the fifth with the sides straighter; the eleventh oval, a little longer than the tenth. Eyes large, rounded, very little or not at all sinuate in front. Prothorax very little wider than the elytra at base, one-fourth wider than long, widest a little before the base, then evenly rounded to apex; base of thorax in front of scutellum nearly truncate or very slightly emarginate. Scutellum triangular, broadly rounded at apex. Anal style short, shorter than the thorax, and blunt at tip. Length to end of the elytra, 4.25 mm.; to end of the anal style, 5.25 mm.

Four specimens examined, presumably females, from New Mexico, labelled Cornell University, Crew Collection. The type is deposited in the Cornell University collection; paratypes are in the possession of the writer.

10. **Mordella knulli**, sp. nov.

This large and very interesting new species of Mordella is known from only one specimen, presumably a female, collected on June 20, at La Belle, Florida, by Mr. J. N. Knull, to whom it is dedicated. It is entirely different in markings from any other North American form of the genus, differing particularly in the distinct silvery pubescent markings on the whole upper surface. On account of its size, it is suggested that this species be placed in taxonomic sequence after *Mordella quadripunctata*.

Cuneiform. Ground-color black. Head densely covered with fine argenteous pubescence, except on a large median triangular spot, where the pubesence is less dense, showing through the black ground color; antennae and palpi black; eyes dull yellowish, transparent, with ocelli and margin black; prothorax with all the margin, except the median third of the apical margin, an angulated band, one third from apex, reaching the side margins, a streak in the middle from apex downward to the middle band, and a streak each side the middle, from the middle band downward not quite reaching the base, with argenteous pubescence (leaving five large spots with black pubescence); scutellum with argenteous pubescence; elytra each with a curved band, from the scutellum outward and downward to about one-third from the base, and then extended outward to the side margin, (leaving a somewhat cordate back spot in the middle of the two elytrons, and a somewhat elongated black spot at the humeral angle) a round spot on each elytron in the middle, very close to the suture, a sutural streak from near the base, slightly widened to one fourth from apex, where it is connected with an oblique triangular band, which reaches the margin, with argenteous pubescence, for the rest covered with black pubescence; under parts black, densely covered with argenteous pubescence, except for a black spot on the posterior margin on the sides of meso and metasternum; a similar denuded spot near the hind coxal plate, and the posterior side margin of the abdominal segments; legs with argenteous pubescence on femora and outer margin of tibiae and tarsi; anal style black, with a little argenteous pubescence near the base. Head rather large, somewhat triangular in shape, finely punctured; antennae

not reaching the base of thorax; joints one to four narrow; fifth to tenth serrate; third and fourth joints equal in length; fifth one-fourth longer than the fourth, and much wider at apex; sixth one-fourth shorter than the fifth; seventh to tenth about equal in length, slightly decreasing in width; eleventh a little longer than the tenth, rounded on the inner angle. Eyes large, obovate, finely granulated; maxillary palpi scalene-triangular. Prothorax one-third wider than long, finely punctured; basal lobe in front of scutellum broadly rounded; sides feebly rounded and converging to apex, the anterior and posterior angles acute; scutellum triangular. Elytra more than twice as long as wide, finely punctured. Tibia of the middle leg longer than all the tarsal joints of the same leg. Anal style long, pointed. Length to end of the elytra, 7.5 mm.; to tip of the anal style, 10 mm.; breadth, 3.5 mm.

The single type specimen is placed in the writer's collection as a gift from Mr. Knull.

SOUTH AMERICAN GLENURUS AND SOME OTHER MYRMELEONIDAE.

BY NATHAN BANKS,

Cambridge, Mass.

A striking new species of *Glenurus* from Bolivia has induced me to review the other species from South America, and I give below a synoptic table to all the forms except one recently described by Navas. Recently Mr. Petersen has furnished me with some photographs of certain types of Gerstaecker, and from these I learn that a species I had considered the *G. psilocerus* is not that but new.

1. Front wings without the large dark apical mark.....*heteropteryx.*
   Both wings with large dark apical marks.....2.
2. In the front wings the space before the apical mark contains many dark spots.....*croesus.*
   In front wing this space largely clear.....3.
3. Dark mark of hind wings with two pale spots.....*peculiaris.*
   Dark mark of hind wings with but one pale spot.....4.
4. In hind wing the apical pale spot is indented by the dark; the dark mark of fore wings has the inner edge lobed, and notched behind.....*incalis.*
   In hind wings the apical pale spot is not indented by the dark; the dark mark of fore wing is not lobed on the inner edge, and not notched behind.....*luniger.*

The *Glenurus discors* Navas agrees with *heteropteryx*, but is said to lack the white in hind wing at tip, and to have shorter hind wing; but this latter character is variable.

Glenurus incalis sp. nov.

In appearance and markings very near to *G. peculiaris*. The wings are rather more slender. The fore wings have the apical mark shaped like that of *G. peculiaris*, except that it is notched behind; the pale area beyond is more uniformly pale, with but two or three dark spots, of a milky and even faintly

pink appearance as in our *G. gratus*. The apical mark of the hind wing is fully as long as in *G. peculiaris*, but with only one pale spot behind, and the apical pale spot is indented by the dark from near tip. Body and legs marked as in *G. peculiaris*.

Expanse, 84 mm.

From Chachamayo, Peru, Nov.

Type, M. C. L., 12030.

Glenurus croesus sp. nov.

In general resembling *G. peculiaris*. The body is deep black, with a pale median line on the pronotum; the legs are yellowish, not dotted nor marked with dark, except that the tarsi are darker. The fore wings have the apical mark much as in *G. peculiaris*, lobed internally but less oblique; the pale band is not as much broken as in *G. peculiaris*. The space before the apical mark contains many dark spots, somewhat in rows, that near the end of the anal is very large and enlarged above.

The hind wings have the apical mark hardly as long as in *G. peculiaris*, with but one pale spot on the hind border, and that much narrowed behind. Wings rather shorter and broader than in *G. peculiaris*.

Expanse, 72 mm.

From the Province of Sara, Bolivia, 450 m.

Type, M.C.L., 12031.

Glenopsis petersensi sp. nov.

Pale yellowish; a black band below and one above the antennae; vertex with two dark submedian spots; antennae dark, annulate with pale, tip darker. Pronotum faintly marked with dark streaks each side, more or less connected with two submedian lines; thorax with pale and dark patches, not very clear; the scutelli with a pale median stripe; pleura with a few dark spots; abdomen with dark spot at base and tip of each segment, behind the dark more extensive. Femora with dark dots and apical bands, tibia with sub-basal and apical dark bands, tarsal joints dark at tips. Wings hyaline; venation mostly white, with some brown streaks and cross-veins; two small brown clouds near end of cubitus, and an oblique mark above end of the anal vein, the upper end the larger; some of the marginal forks brown, or with brown spots. In the hind wings some of the veins partly or wholly dark, no clouds; stigma of both pairs white. In structure very similar to *G. anomala*, but the hind wing is scarcely, if at all, longer than the fore wing.

Expanse, 83 mm.

From Chachamayo, Peru, Nov.

Type, M. C. L., 12044.

I had identified this as probably the *G. psilocerus* of Gerstaecker, but Mr. Petersen, to whom I sent a specimen, said that it is different, and kindly sent me a photograph of Gerstaecker's species, which is hardly more than a variety of *G. anomalus*.

Austroleon latipennis sp. nov.

Face pale, a dark indented mark below the antennae; vertex mostly brown, a faint pale transverse line in front, and about three pale spots behind; antennae brown, annulate with pale; pronutum with two broad brown submedian stripes; rest of thorax pale, with four rows of spots, or interrupted stripes; pleura with many dark marks; abdomen dark below, above pale, with a median dark line; legs pale, front femora above and tips of tarsal joints dark. Wings hyaline; veins pale, with dark spots at joinings of veins, gradates and marginal forkings brown; median vein plainly marked; hind wings much less marked, except subcosta and radius. The wings are very broad, especially toward the tip, as in *A. stictogaster*, and the tips acute and almost sinuate behind.

Expanse, 43 mm.

From Chapada, Brazil (H. H. Smith).

Type, M. C. L., 12032.

Differs from *A. stictogaster* in markings; related by marks to *A. argentinus*, but differs by very broad wings.

Hesperoleon tripunctatus sp. nov.

In general appearance very similar to *H. sackeni;* the abdomen has the same pale spots, but those on the posterior half are plainly longer and broken by dots and streaks, and there is white hair on the pale spots of all the segments. The face, instead of the two oblique spots of *sackeni*, has a large black interantennal mark, reaching below the antennae and there nearly straight across. The vertex is fully as high as in *sackeni*, and has a band in front and behind two submedian, and farther back a median dark mark. The pronotum has three dark stripes, not reaching in front of the transverse furrow, the median one broader behind, and there including a pale spear-mark; near the front margin are four faint, dark spots. The thorax is spotted with pale and dark much as in *sackeni*, but on the mesoscutellum are three very prominent shining black spots along its hind border, each on an elevated area; on the metascutellum the apical median spot is also shining black and elevated. The pleura are pale, spotted with dark. The legs are marked much as in *sackeni*, with long white and some black bristles; the fine hair is mostly black. The wings are marked very much as in *sackeni*, and the venation is generally similar, with a wide apical area, but the radial sector arises more basally, and there is but one series of cells between the cubitus and the anal in the fore wings.

The male genitalia are extremely short, and not at all extended, less than one-half as long as the last segment, but there is a lobe below at base as in *sackeni*.

Expanse, 48 mm.

From Palmerlee, Arizona, June, July, (Biederman).

Type, M. C. L., 12043.

Readily separated from *H. sackeni* by the three shining black spots on the Mesoscutellum.

ON THE GENUS ELIDIPTERA SPIN. (HOMOPTERA)

BY F. MUIR,

Hawaiian Sugar Planters' Experiment Station, Honolulu, T. H.

Elidiptera Spinola 1839, Ann. Soc. Ent. Fr. viii, p. 304. Logotype, *callosa* Spin.

Among some Homoptera forwarded to me by Mr. C. B. Williams from Trinidad is a specimen that I at first considered to be a new genus near to *Achilus* but later identified as *Elidiptera callosa* Spin. or a very closely allied species. I was acquainted with this genus by species from North America and the West Indies and so failed to recognize *callosa* as belonging to it.

The genus was erected for *callosa* and some other species and was illustrated on plate 15, figures 2, 3 and 4 of the same work. The figures indicate that *callosa* differed from the other two species, *advena* and *marginicollis*.

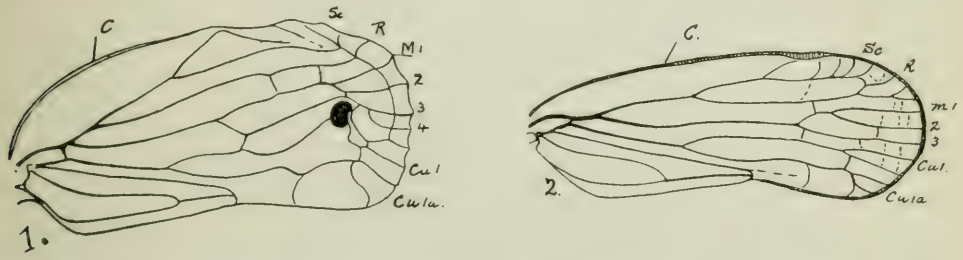

Fig. 1—*Elidiptera callosa* Spin., right tegmen; fig. 2—*Elidiptera* (?) *woodworthi* Van D., right tegmen.

Text figures 1 and 2 illustrate the tegmina of *E. callosa* and *E. woodworthi* and show the difference between them. In the former Sc and R fork near the base and R is simple. M_1 forks about the apex of clavus, and there are five apical Ms. In the middle of the apical third of the tegmen there is a round callus which causes the apical third of the tegmen to curve, the upper surface convex and the lower concave. This throws all the apical veins out of the straight, especially the Cu_1 and M_{3+4}. The effect of this is to give the tegmen a twisted appearance indicated by its generic name.

In *E. woodworthi* Van D. the tegmen and venation is of the normal Achilid type, the tegmina overlapping when at rest and the veins are but slightly curved or bent but not twisted. The fork of Sc and R is further from the base and R has three apical veins. The first fork of M is well beyond the apex of clavus and has three apical veins.

In *E. callosa* there is one pronotal carina on the shoulder, in *E. woodworthi* there are two.

For these reasons I do not think that they can remain in the same genus.

Some of the species at present under *Elidiptera* Spin. will fit into *Angelcusa* Kirk. and have a distinct median carina on the clypeus. Other species, such as *E. woodworthi*, have no median carina on clypeus and I am uncertain of their correct position.

NEW CICINDELAS OF THE FULGIDA GROUP. (COLEOP.).

BY EDWIN E. CALDER,

Longmeadow, R. I.

Cicindela azurea, new species.

General form of *fulgida* but somewhat larger and a little more elongate. Above deep bluish green with strong metallic lustre. Beneath bluish green; surface of the abdomen, legs and thighs very thickly clothed with white hairs; legs deep blue. Maculation; humeral lunule wider than in *fulgida*, unbroken at the shoulder, longer, almost reaching the middle band. The middle band uniform in width, reaching the margin, not dilated thereon and only very slightly prolonged backward. The descending portion of the band longer and more drooping than in *fulgida*, closely approaching the apical lunule. Length, 13 mm. Width, 5 mm.

This form resembles *C. parowana* as to color and general appearance but differs very markedly in the character of the middle band.
Two specimens from Penticton, B.C., J. B. Wallis, August 13, 1909.
Type in J. B. Wallis collection, Winnipeg, Man.
Cotype in E. E. Calder collection, Longmeadow, R. I.

Cicindela fulgida elegans, new var.

Form, size and general maculation similar to *fulgida*. Above deep chestnut brown with distinct metallic purple lustre. Beneath, lower part of the abdomen deep greenish black; upper part, extending from sternum to the head, copper bronze, more pronounced on the sides of the thorax. Markings very similar in character to *C. parowana*. The humeral lunule uniform in width, unbroken at the shoulder, less oblique than in *fulgida*, longer and more drooping extending almost to the middle band. The middle band shorter and less angular than in *fulgida*, extending to the margin, largely dilated thereon and prolonged backward but not to the marked degree as in *parowana;* the descending portion of the band elongate and drooping, closely approaching, but not quite reaching the apical lunule.
Length, 12 mm. Width, 5 mm.
Westbourne, Man. J. B. Wallis, August 14.
Type in E. E. Calder collection, Longmeadow, R. I.

Cicindela fulgida subnitens, new var.

Similar in size, form and maculation to *fulgida*. Above, dull black, much less metallic than *fulgida*. Beneath wholly black, without any tendency to greenish.

This form may possibly be only a color variety of *fulgida* but the decided departure from the type as noted in the black color of the under surface deserves recognition.
Lincoln, Nebr., F. N. Schoemacker.

NOTES ON NORTHERN BRITISH COLUMBIAN COLEOPTERA.

BY MRS. W. W. HIPPISLEY,

Terrace, B. C.

Terrace is a small town situated on the Grand Trunk Pacific Railway in the fertile valleys known as Lakelse and Kitsumgalum, ninety-five miles east of the terminal at Prince Rupert and 500 miles northeast of Vancouver. The two valleys are separated by the Skeena River, that called Lakelse lying to the south and Kitsumgalum to the north; taken together they number some 200,000 acres, Lakelse being the larger of the two. The soil is varied, a stiff clay on the flats, sandy by the river and gravelly on two large plateaus. The district is heavily timbered with spruce, hemlock, cedar and cottonwood, some yellow pine and yellow birch, and a sprinkling of balsam fir; some of the older clearings are overgrown with poplar and birch saplings, alder, elder, and willow.

Most of the insects collected during the past two years have been taken on or near our ranch "West Lodge," some three and one-half miles southwest of Terrace as the crow flies, or six miles by the road. Most of this material has been forwarded to Mr. C. A. Frost of Framingham, Mass., to whom I am indebted for the identification of the species mentioned in the following notes. It is hoped that they may prove to be of some slight interest and value, coming as they do from a country so far north and one almost entomologically unknown.

Elaphrus riparius Linn. In two years collecting on the south side of the Skeena River, this handsome insect has only been taken in two places; the first time on the margin of a small pool on a flat some 50 yards distant from a spring creek, where they were driven from cover by treading about on clumps of a fine sedge while searching for water beetles, about the first week in June, 1920. Ten days or so later they were found in some numbers on a part of the garden, behind the house, that had been flooded throughout the spring by the water from a small swamp. This stagnent water supported a thick growth of algae and when the water failed this algae with myriads of tadpoles formed an evil-smelling scum that dried in flakes, beneath which were found the *Elaphrus*. Both garden and pool were in the full glare of the sun.

From comparison with the types in the LeConte collection, I am informed that many specimens of this series agree with *punctatissimus* Lec. while others are more like *similis* Lec. in shape. Among these taken near the garden were a few that were of a red-bronze tint, instead of the usual green; these specimens are also slimmer with narrower thorax and of a shining brassy color beneath, less green on the femora, metasternum smooth and shining, ventral segments less hairy, punctation beneath less deeply impressed and more scattered, especially toward the apex. As this insect somewhat resembles *pallipes* Horn, it may be the form described from B. C. as *purpurans* by J. F. Hausen (Can. Record of Sci. IV, 1891, p. 251) and listed as a variety of *pallipes*, but the Terrace specimens do not have the legs paler than in *riparius*, while the elytral apices are not narrowed, nor is the punctation of the propleura and sides of abdomen as sparse as in *pallipes*.

Elaphrus clairvillei Kirby. Two specimens of this species were taken

about the same time, and they are identical with the eastern specimens of this species.

Elaphrus clairvillei frosti new var.

This very pretty insect differs from Kirby's *clairvillei* in its narrower thorax with median and sub-apical impressions more deeply indented, and with the discal elevations more sparsely and finely punctate, while the under surface is less coarsely punctate and the side sutures less sinuate; the front of the head is narrower and the eyes proportionately larger; elytra not so shining, with the punctation very fine, scattered, and not in wide rows between the discal foveae as in *clairvillei;* the color of the entire upper surface is deep, rather dull, olivaceous green (almost exactly as in *olivaceus* Lec.) with smaller purplish foveae; under surface a lighter shade of green; tibiae and femora colored much as in *clairvillei*, with the tarsal joints slightly darker. The specimen at hand measures 8 mm. while a specimen of *clairvillei* is slightly over 9 mm., and is of a much more robust form.

This strikingly distinct form, which seems almost to merit a higher standing than a mere variety, is dedicated to Mr. C. A. Frost in recognition of his great assistance to the writer. The type is in his collection.

Pterostichus herculaneus Mann. This species is one of the first beetles found in the spring, when it is present in small numbers, perhaps two or three at a time, beneath the loose bark of cottonwood logs and stumps, and under the bark of partially decayed hemlock and yellow birch. In autumn their habits are slightly different, as they then seek shelter for the winter in powdery dry stumps, dry rotten logs (hemlock or poplar preferred), at the bases of moss-covered cottonwood stumps, or under a sunken mossy log. They occur at times with *Ipthimus opacus* in decaying logs or beneath loose bark. The species is not very plentiful and one could perhaps take a dozen in a day by diligent search.

Hydrobius scabrosus Horn. A few specimens of this beetle were taken in May, 1920, from beneath moss growing at the edges of a rapidly flowing creek. The temperature of the water is about 45 degrees Fahr. both in summer and winter. The moss is partially submerged and grows on sunken logs, branches and twigs that have fallen into the water. The beetles are not seen until the moss is pulled off and laid on the bank upside down, when they commence to crawl about. On March 29, 1921 (since writing the above note) while there was still two feet of snow on the ground, four more specimens were taken from this moss after being gathered in the creek and carried to the house.

Eros simplicipes Mann. About half a dozen of this pretty Lycid were taken on the wing, the last of May, 1920. The flight is weak and wavering, about six feet off the ground, and they are easily captured by hand. They often light on the dress or hand of the would-be captor as they dance about in sunny glades among the green timber on still warm days. The red of the elytra has a distinct orange tint quite noticeable when compared with examples of *hamata* or *aurora*. The quadrate impressions of the elytral intervals are very even, the costae fine; the tibiae and femora are red, the tarsi black as are the antennae, though the head and first joint of the antennae have a reddish tinge. Length

of male 12 mm. My correspondent writes me that these specimens are identical with those so named in the LeConte collection.

Eros nigripes Schæffer. With the preceding species were taken five specimens having the legs, antennae, head and under parts black throughout; antennae broader and heavier; color of elytra deep scarlet, with the quadrate impressions of the intervals irregular and uneven in size, costae much coarser and the form broader than in *simplicipes*. Length 9 to 10 mm. There is one specimen of this species in the LeConte collection at Cambridge, Mass., without name. A specimen of this has recently been sent to Mr. Charles Schæffer of the Brooklyn Museum who states that he cannot see that it differs from his *nigripes* which was described from Minn. (Jour. N. Y. Ent. Soc. Vol. XIX, 1911.) except in the slightly weaker thoracic costae.

Eros hamata Mann. Four specimens of this handsome species were taken in 1920, usually while resting on the trunk of a green spruce. The quadrate impressions in this species are thickly covered with short appressed hairs of the same color as the elytra and thorax; the legs are red and the tarsi piceous; the head, first antennal joint and metasternum dull red; ventral segments black except the last which is brownish yellow. Length 15 mm. The specimens correspond with those named as above in the LeConte collection.

Lucidota (*Ellyschnia*) *corrusca* Linn. This is extremely common here all the season, being one of the first insects to appear after the snow melts, and one of the last to go in the autumn. It is very partial to the flowers of the pearly everlasting.

Silis spinigera variety *munita* Lec. One specimen was taken in June, 1920, on the flowers of the red osier willow or dogwood.

Silis pallida Mann. Three specimens taken; two flying about fire-weed blossoms and one resting on a thimbleberry leaf, June to July, 1920.

Calopus angustus Lec. Seven specimens of this rare Oedemerid were taken in the early part of the spring of 1920, five being taken before all the snow had melted. These were all found beneath the loosened bark on decaying pine stumps from which they seemed to have recently emerged as fresh holes were noticed in each case close to the sweil of the roots. A week or so later one was found drowned in a tub of rain water by the door early in the morning. It seems probable that its early appearance in spring together with the indications that it flies at night, may account for its rarity in collections. The seventh specimen was taken from the water tank of a gasoline engine.

Omosita discoidea Fab. Two fragments of the knuckle-end of a beef shank yielded upwards of one hundred of these little insects during a space of about three weeks at the end of May and beginning of June, 1920. They crawl into the fine bony net-work and can scarcely be seen until breathed upon. When the bone is sharpely tapped on a board or table they fall out. Only bones having this net-work of fibre seem to attract them. In this species the yellow markings of the elytra are sub-basal to median instead of apical as in *O. colon*. *Discoidea* also has scattered flecks of yellow toward the elytral apices.

Leptura aspera parkeri new var.

Form longer and slimmer, elytra reddish-testaceous (of a shade similar to that of some of the redder forms of *Brachyleptura rubrica* Say) with the punctation much finer and the asperities not so pronounced, tips rounded and margined; the head is more sulcate with finer punctation, with the first four joints of the antennae more shining, not so coarsely punctate or hairy as in the black form, fourth joint two-thirds the length of the third and the two together but slightly longer than the fifth. Two of the abdominal segments have the apical margins glabrous with a cross band of yellow-brown, last segment brown with a fringe of yellow hairs. Length 14 mm. Width 3 mm.

This form has been given the varietal name *parkeri* in honor of the author's father whose keen interest in the insect fauna of this region has been a great encouragement to the writer. The type has been placed in the collection of Mr. C. A. Frost of Framingham, Mass.

A FURTHER NOTE ON THE GENUS PLATYPREPIA (LEPIDOPTERA)

BY J. MCDUNNOUGH,

Entomological Branch, Ottawa.

It had been my intention to consider the matter of the family position of the genus *Platyprepia* closed with the publication of Dr. Dyar's reply (Can. Ent. LIV, 20) to my previous statements (Can. Ent. LIII, 167). Unfortunately however an 'Author's note,' inserted by Dr. Dyar in the page proofs of his article and set up by the printer without consultation of the editor, calls for a reply as the statement contained therein is erroneous. Dr. Dyar claims in this note that, whereas in *Platyprepia* veins 7 and 8 of secondaries are separated at the base, in *Arctia* they are united, and he would use this apparently as a character to differentiate the two families Arctiidae and Hypsidae. It might be pointed out in passing that if this character should be used, then *Apantesis* and numerous other Arctiid genera would fall into the latter family. However, as a matter of fact, vein 7 in *Arctia* does not coalesce with 8 to the extreme base of the wing; it branches off from 8 about 2 mm. from the base in exactly the same manner as is found in *Platyprepia;* in both genera it is much reduced in size as compared with 8, which is greatly swollen at the base, and this reduction of size has been carried almost to obsolescence in some specimens of *Arctia caia;* an examination of a series of this species, especially large females, clearly shows however the basal separation of the two veins and I have specimens before me as well marked in this respect as any of *Platyprepia guttata.*

While I have no objection to the transference of *Platyprepia* to the Hypsidae if sufficient proof of the soundness of this transfer can be given, I do claim that up to the present neither Sir Geo. Hampson nor Dr. Dyar has given us satisfactory reasons for making such a change.

NEW SPECIES OF THE SYRPHID GENUS CHILOSIA FROM CANADA (DIPTERA)

BY C. HOWARD CURRAN,
Orillia, Ontario.

(Continued from Page 20)

Chilosia orilliaensis, new species.

Eyes pilose; arista black, bare; thorax deep blackish green, its dorsum cupreous bronze; abdomen shining blackish green, first two segments chiefly opaque; wings clouded or infuscated with dark luteous; scutellum with bristles which are scarcely distinguishable in the male owing to long pile; third antennal joint small, reddish, black above; abdomen of female almost wholly shining.

Male. Length 8 to 10 mm. Face and front shining greenish black, thinly covered, except the tubercle, an area on its lateral slopes and the cheeks, with fine whitish pubescence which is condensed as a band below the antennae; side margins with whitish pile, face elsewhere without pile; in profile very slightly concave or almost straight to the tip of the large, rather prominent nose shaped tubercle, thence shortly concave to the oral margin, which is convex, not quite as prominent as the antennal base and much less prominent than the tubercle. Frontal triangle a little prominent, in the middle with a more or less distinct brassy tinge; in the middle with a rather broad longitudinal depression which is narrower above; margins very narrowly white pollinose; pile of frontal triangle rather stout, long, black. Antennae luteous or brownish luteous, first joint always darker, third joint about equal in length to the first two, small, little longer than broad, its lower end usually more sharply rounded. Arista long, slender, bare, black, the sub-basal quarter a little swollen. Vertical triangle dull black, black pilose in front, yellow behind, sometimes nearly all black or with chiefly yellow pile. Eyes brown or yellowish brown pilose on the upper half with yellowish or grayish yellow pile below. Posterior orbits narrowly white pollinose on lower two-thirds, with opaque black pollen on the upper half except against the eyes at the upper three-quarter area; the pile is white on the lower half, more brown or blackish above and the hairs ovrhanging the eyes are black.

Thorax and scutellum shining blackish green, the dorsum, except the sides, with a cupreous bronze reflection. Pile variable, but usually chiefly black on the dorsum, intermixed with some yellow or fulvous hairs on the disc, sometimes almost wholly black pilose, but often the pile is chiefly yellowish or fulvous with the borders black pilose; there is always black pile at the humeri, base of the wings and on the postalar calli; pile on the upper half of the pleura almost always wholly black, but sometimes a few pale hairs intermixed, the lower half always whitish pilose. Scutellum usually with almost all long black pile, with a few paler hairs at the base but these sometimes wanting, at other times chiefly yellow pilose with black pile apically. In these latter specimens the scutellar bristles are usually quite distinct. The other bristles on the thorax are not conspicuous in the males.

First abdominal segment more or less brownish, scarcely or moderately shining, the angles below the scutellum reddish brown, and often the anterior margin more or less yellow pollinose; if shining, with a greenish reflection. Sec-

ond segment opaque black, the anterior margin very narrowly shining, the side margins, more broadly in front, shining greenish; third segment opaque, the apex very narrowly shining, and apparently inclined to be reddish in some specimens, lateral margins shining greenish, expanded in front to occupy about one-third the width of the segment on each side, but the shining area indistinctly defined. Fourth segment wholly shining, and usually with a metallic bluish reflection, but sometimes metallic blackish green. Hypopygium shining blackish green, finely, sparsely whitish pubescent and with mixed yellowish and black pile. Pile of the abdomen moderately long, on the basal angles long pale yellowish, yellow or fulvous, the sides of the abdomen with similar colored pile to that on the basal corners, except the apical quarter to half of each segment, the light colored pile extending as triangles on the basal corners of each segment; pile elsewhere black or brown.

Legs shining greenish black; tips of the femora, anterior four tibiae except a broad band mostly beyond the middle, yellow; apex of hind tibiae and first two joints of middle tarsi reddish, brownish yellow or brown; anterior tarsi brown basally in most specimens. Wings strongly tinged with brownish or brownish yellow, more so anteriorly; veins brown; stigma yellow. Squamae yellow, tinged with brown, with brown margin and brown fringe. Halteres luteous, the tip of the knob brown.

Female. Antennae reddish, basal joint usually brownish, third joint larger than in male, brownish above and apically its end truncately rounded but frequently more pointed below. Face moderately concave between the antennal base and the small but prominent tubercle, only slightly concave below the tubercle. Front shining black, with a brassy reflection in the middle; a shallow longitudinal median groove usually indistinct just after its inception a little above the antennae, running to the ocellar triangle; lower quarter of front silvery white pollinose contiguous to the eyes, above which the sides of the front are black. Pile of the front usually nearly all yellowish with black pile across the ocelli, some black hairs intermixed above the antennae, the vertex with yellowish pile. Posterior orbits thinly grayish pollinose above, white below.

Thorax and scutellum shining blackish green, the dorsum with a more or less distinct brassy or bronze reflection. The pile of the dorsum is short reddish yellow, on the pleura long, white; postalar callosities with two black bristles, two to four short ones above the base of the wings, and rarely a long slender one on the posterior part of the mesopleura; scutellum with short white or pale yellow pile and from four (usually six) to eight long slender black bristles on the apical margin.

Abdomen shining blackish green or blackish; first segment with the corners below the scutellum reddish luteous; second segment with an obscure opaque area on the anterior three-fourths occupying about one quarter the width of the segment, or less, on each side of the middle and often interrupted longitudinally by a shining median line; third segment with a similar but smaller subopaque marking, but sometimes there is scarcely a trace. Pile on the abdomen yellow, on the base and the lateral segmental triangles usually whitish; the antero-lateral more smooth triangles are limited by a condensation of subappressed yellowish pile; on the apical half of the disc of the third and fourth segments the pile chiefly appressed black, but the yellow hairs which are intermixed are most prominent.

Legs as in the male but the bands on the anterior four tibiae are narrower and brownish, the basal three joints of the anterior four tarsi are reddish. Squamae white, with white fringe. Halteres yellow. Wings as in the male, but frequently more clouded beyond the middle anteriorly.

Holotype, ♂, Orillia, May 8, 1921. *Allotype*, ♀, Orillia, May 22, 1921, collected by the author, in the Canadian National Collection, Ottawa.

The descriptions are drawn from 57 ♂ and 81 ♀ specimens, taken at Orillia between May 5th and June 18th, 1920 and 1921 and one male, Ottawa, Ont., May 22, 1921 (J. McDunnough).

The species shows considerable variation in the color of pile, antennae and legs, and also the facial tubercle is more or less variable. Occasional females have the oral margin more prominent than described, but this varies and intermediate specimens occur. The shape of the third joint of the antennae varies especially in the females. In many specimens the end of the third joint is more produced below, while in others it is rounded rectangular and narrower, being not twice the width of the second joint at its broadest.

This species is very close to *hoodiensis* Bigot, but is at once distinguished by the lighter pile of the face and the paler pile generally. In *hoodiensis* the thorax is black pilose. From *borealis* Coq. it is distinguished by the lighter antennae, bare arista and opaque abdomen. From *occidentalis* and *petulca* by the paler antennae, darker pile on thorax and abdomen as a rule and abscence of hairs on facial slopes. In Hunter's key (Can. Ent., vol xxviii, p. 229) the female traces out to *laevis* Bigot but is readily distinguished by its larger size, etc.

A very abundant fly on Cowslips, fairly abundant on Wild Cherry in the vicinity of deep woods and on flowers of *Osmorrhiza claytoni* in sub-swampy woods. The most common species of the genus in Ontario. Other species are frequently taken in company with it. Males are most abundant towards evening.

Chilosia columbiae, new species.

Antennae small, arista bare, black; eyes yellow pilose; thorax wholly light yellow pilose; second and third abdominal segments more or less opaque; legs black, only the knees obscurely reddish.

Male. Length 11 mm. Face shining black, thinly covered, except the tubercle, with yellow pollen which forms a broad band across below the antennae and extends narrowly down along the eye margins to the cheeks; side margins short yellowish pilose. Front not prominent; a deep sulca rising just above the polished antennal arch and reaching quite to the juncture of the eyes; in color metallic blue, with wholly yellow pile; front densely punctulate in vicinity of sulca, the sides obscurely golden yellow pollinose. Antennae brown, shining; third joint about twice as broad as second, a little longer than broad, its end rounded, in color opaque yellowish red, its upper and apical border brown, dusted with whitish. Arista black, bare, longer than antennae, slender, the basal quarter a little thickened. Vertical triangle shining greenish black its pile yellow, but most of the hairs blackish on the anterior half. Posterior orbits yellow pollinose and with yellow pile, including the occipital ciliae. Eyes moderately densely yellowish cinereous pilose, whitish below.

Thorax and scutellum shining blackish green, the dorsum with a strong brassy reflection, pile luteous yellow, not long but rather dense; pleura and scutellum with similar pile, no trace of bristles.

Abdomen metallic blackish green, slightly brassy; first segment moderately shining, the corners under the scutellum brown; second segment opaque black, except the very narrow posterior margin and the sides broadly, the opaque area cut off nearly squarely at the sides; third segment with a rather broad abbreviated opaque band near the hind margin in the middle, but with a very slender shining median stripe interrupting the opaque longitudinally; the opaque outline is vague; anteriorly and contiguous to the opaque markings and extending across the anterior margin there is a metallic deep blue reflection. Pile on opaque areas short, black, elsewhere longer, yellowish.

Legs black, the knees obscurely reddish. Pile of the legs similar to that of thorax; decidedly short reddish beneath the femora and tibiae apically and beneath the tarsi; a patch of golden pubescence at the bases of the anterior four femora. Wings distinctly fuscous, more marked basally and anteriorly, almost hyaline posteriorly; veins brown; the tip of the fourth vein joins the third longitudinal at almost a right angle. Stigma yellow. Squamae pallidly yellow with yellow border and pale yellow fringe. Halteres brownish luteous, the knob brown.

Holotype, ♂, Cranbrook, B.C., May 8, 1920, (C. B. D. Garrett), in the writer's collection.

This species is very like *C. lasiophthalma* but the pile is lighter, the face is less produced downwards, and the abdomen is more elongate. It must closely resemble the male of *punctulata*, but the thorax is not densely punctulate, the arista is wholly black and the thorax is very shining. It must also be very similar to *sororia* from Mexico, but the brassy thorax will distinguish it from that species. It differs from *petulca* in the abscence of bristles on the scutellum.

Chilosia rita, new species.

Arista bare; eyes bare; thorax and scutellum yellow pilose, the latter with black bristles; wings with yellowish brown cloud.

Male. Length 10 mm. Face and front shining blue black, a grayish pollinose band below the antennal prominence; side margins with short whitish pile; tubercle large, Roman nose shaped; face sub-triangularly concave from tip of antennal prominence to tip of the tubercle but the lower half of the concavity formed is convex; below the tubercle perpendicular to the oral margin, the anterior tip of which is on a plane with the posterior oral cavity. Frontal triangle with strong metallic blue reflection, with a broad sulca rising at the antennal arch and reaching the eyes at their juncture, the pile moderately long, black, not longest above. Antennae brownish red, first joint black, third joint as long as the first two together, oval, a little flattened above; arista long, slender, a little thickened near the base. Posterior orbits grayish yellow pollinose below, opaque black above, below with sparse whitish pile, above with black, but at the vertex with short yellow pile, the orbital ciliae black. Vertical triangle black pilose, the hairs at the back yellowish basally. Eyes contiguous for long distance, the vertical triangle small and narrow.

Thorax and scutellum shining blackish green, the dorsum with a brassy

lustre, the pile luteous, on the sides of the dorsum and on the mesopleura black, moderate in length, longer on the scutellum which bears apical slender black bristles.

Abdomen shining greenish with a brassy reflection; first segment with about six transverse impressions; second segment opaque, the side margins, expanding in the middle and extending obscurely (subopaque) entirely across, shining; third segment similar, but the middle of the segment less opaque and the shining band less broadly subopaquely interrupted. Pile of the abdomen reddish yellow, paler on the sides. Hypopygium with some black hairs intermixed.

Legs black; tips of the femora and all the tibiae reddish yellow, the latter with a rather broad blackish band, tarsi yellow, the last joint and hind basitarsi except the tip, brownish. Legs with long pale yellow pile, the anterior four femora with black pile apically and fulvous pile antero-ventrally, hind femora with short bristle-like black pile beneath.

Wings clouded with luteous, veins mostly piceous, but brown posteroapically; stigma yellow. Base of 2-3 longitudinal vein with about 12 short, fine bristles. Squamae whitish yellow, fringed with luteous and with luteous fringe of pile. Halteres yellow, the knob darker.

Holotype, ♂, Orillia, Ontario, May 5, 1921, (C. H. Curran) in the author's collection.

Differs from the species of the *tristis* group in having bare arista, and in addition may be distinguished from the species in that group as follows: from *pallipes* in having no pale markings on thorax; from *tristis*, *similis* and *leucoparea* in its more extensively yellow legs, etc; from *skinneri* in its larger size and largely black legs.

Chilosia rita, new species.

Antennae luteous, arista brown, bare; face with fine pile on slopes; front as long as face, not sulcate.

Length, 7.5 to 8 mm. al. 7.5 mm. ♀ Face and front shining black, the sides of the face and across below the antennae silvery pollinose, extending very narrowly up the sides of the front on the lower fifth; face considerably concave between antennae and prominent tubercle, and thence perpendicular to the oral margin which is only slightly below the eyes at its anterior point; face with very fine whitish pile on lower central slopes and short silvery pile on side margins; front with short whitish pile below, with longer black or brown pile on upper two-thirds and immediately above the antennae and a few scattered black hairs among the pale ones; posterior orbits white pilose below and with whitish gray pollen, black opaque above with black pile. Eyes bare antennae reddish yellow or luteous, the basal joints infuscated, third joint a little darker dorsoapically.

Thorax, scutellum and abdomen blackish blue, wholly shining; thorax chiefly short black pilose, but when viewed from in front appearing whitish; there is a triangular area of yellowish pile on the front of the dorsum, the pleura entirely whitish pilose. Scutellum with brownish yellow or brownish pile, appearing pale in most lights, its margin with three or four pairs of black bristles, and some stout black hairs laterally; postalar calli and the sides of the dorsum before and behind the suture with two to four black bristles, and

one to three bristles on the mesopleura. Abdomen wholly sparsely whitish pilose, pile a little longer basally, sub-appressed except on the anterior angles of the second, third and fourth segments. Femora black, their tips luteous; front coxae obscurely luteous, as well as a spot on the thorax above them extending to the partly obscurely luteous humeri. Anterior four tibiae luteous or yellowish with broad, ill-defined median blackish bands, hind tibiae paler at ends only; tarsi obscurely luteous, the apical joints darker; hind tarsi more brownish.

Wings almost hyaline, stigma pallidly yellowish; veins brown, yellow at base of wing; first posterior cell acute, last section of fourth vein a little bent at its basal fifth. There are five minute bristles on R_{4+5} before the furcation. Squamae white, with whitish fringe; halteres yellow.

Holotype, ♀, Macdiarmid, Ont., June 7, 1921, (N. K. Bigelow), in the Ontario Museum, Toronto.

Paratypes, ♀, same data, in the Ontario Museum; ♀, same data, in the writer's collection.

This species is distinct from any so far described from North America in having the eyes bare and the facial slopes pilose. It belongs to a distinct group, although its general structure places it close to the *tristis* group.

AN APPEAL FOR AID.

The following letter which has been received by the Secretary of the Entomological Society of Ontario speaks for itself.

Dear Sirs:—The "Mikrographische Gesellschaft" has been in existence in Vienna for ten years and has at present about 50 members.

Its object is to popularize microscopy or rather those branches of the natural sciences which rely upon the study of the universe in the smallest space. At the same time it extends and affords opportunities to non-members to whom the use of our laboratory, consisting of five rooms, is offered gratuitously.

Through the extreme decline in the value of Austrian currency its finances have come into a most critical state. Before the war the society was able to cover its expenses and the upkeep of the laboratory out of its modest income. But our means are now exhausted and we are unable to procure even the most urgent expedients, such as instruments, reagents, colours, glass articles, photographic supplies, etc., the prices of which have arisen enormously, not to mention the increased cost for gas and electric current.

Without prompt assistance the society will soon be obliged to dissolve and to deprive the intellectual people of our unhappy city of a place of scientific study and research.

The unfortunate, poorly nourished intellectual classes of Vienna are facing a winter of hardship and privation which acts as a spur to seek education and enlightenment with a view of paving the way for a better future for themselves, and, let us hope, for the benefit of all mankind. We therefore beg leave to appeal to you, Gentlemen, who are pursuing similar noble objects, to make it possible for us, through an accommodation in your own sound money, that our society may be saved and continue with its work.

Please accept our heartiest thanks in advance.

We are, Gentlemen, gratefully and sincerely yours,

Mikrographische Gesellschaft Wien,

Treasurer; Paul Frenzel, Vienna vi, Theobaldgasse ii.

Mailed May 26th, 1922

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POPULAR AND PRACTICAL ENTOMOLOGY

METHOD OF PROCEDURE IN INSECT LIFE HISTORY INVESTIGATIONS.

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It is hardly necessary to emphasize the importance of life history investigations as an aid to the control of injurious insects. To the economic entomologist is allotted the development of methods of suppression, and without some knowledge of the life history of the insect in question, his efforts to control may be futile. It is, therefore, clearly obvious that the first effort in attacking the problem of insect control must be the acquisition of an understanding of the insect's life history.

The writer as a novice in entomology, about seven years ago, was assigned to Southern Kansas and placed in charge of a field laboratory established for the purpose of working out the life histories of two serious insect pests of that part of the state. At the time a prepared schedule was furnished for the methodic study of insect life histories. Since then the value of such a schedule has been more fully realized. Investigators are far too frequently found who do not realize how much they know about a given subject or animal until they have subjected themselves to the processes of orderly arrangement when the results obtained are found to be surprising and satisfactory. Often there has been no attempt to classify data which are obtained by a poor method of approach. Their knowledge is merely a mass of scrambled observations, which, if untangled, may lead to many unconsidered possibilities, and in recording their facts they are apt to omit many important matters which are overlooked in a forest of tangled ideas. They do justice neither to themselves nor their readers. They may have many times the number of facts which they record and the reason they are not recorded is the lack of systematic arrangement. Far too many life history papers exhibit this defect. Undoubtedly a partial solution of, or at least an improvement in the character of life history investigations, lies in the possession and use of an orderly plan, as is here suggested.

The first and most important starting point is an accurate determination, by a specialist, if necessary, of the species under consideration. Its correct scientific and all common names should be known, and a complete bibliography should be made up. Special literature should be secured and copies of state and national laws affecting entomology should be available, especially those pertaining to quarantine regulations if the species may in any way be involved in legal entanglements.

After the bibliography has been prepared, the investigator has learned

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what is known about the insect. Adequate laboratory facilities should then be available and a system of record keeping established. This should include besides observations on the animal, statistical, climatological, geological, and miscellaneous data that may have a bearing on the species in question.

The first steps in such a study will depend to a large extent on the time of year in which the work is begun and the corresponding stage of the insect's development. That is, if work is begun in the spring and the insect is in the adult stage, the first observations will be on the mature form. However, a logical treatment should begin with the egg and the study develop as the insect proceeds through its various stages of metamorphosis. In the egg stage there are at least four important points to be noted; first, an adequate description of the egg which will permit of it being recognized by others; second, the embryology or development of the egg. This point is important and a great amount of data can be amassed on the one subject. Nelson's "Embryology of the Honey Bee" is an example of the vast amount of material that can be assembled on the development of an insect egg. The third point is the duration of the egg stage which should be known under different climatological conditions which affect the length of time required for development. Large series should be studied in order to obtain averages with a minimal probable error. Lastly, the method of hatching should be carefully investigated. This is often a weak and critical stage in the insect's life and important control measures might suggest themselves at this time. More will be said concerning oviposition habits of the adult insect.

The next stage is either the larval or nymphal, depending on the kind of metamorphosis, and here a good description is desired and the anatomy both external and internal should be worked out. The rate of growth and number of moults are important. It is surprising how little is known of the method of moulting and the frequency of its occurrence in many of our common species.

The process of moulting may be variable and the food supply may have a decided influence on the time of moulting. The size of the insect in each instar may have an important significance. Davis, of Indiana, is now working on the size of the various instars of white grubs and can identify species by their size, and Dyar has devised a system of proportions whereby the various sizes of caterpillars can be computed if the size of one instar is known. The duration of the complete stage varies and in many larvae a prepupal condition is assumed. This again is a critical stage where effective control measures may be applicable if the species is destructive. Before pupation, pupal cells are often constructed, a knowledge of the method and the locality where they are built being desirable. Habits of feeding and methods of securing protection are important, and the character and degree of injury are vital points. The rearing of large numbers over a series of years is desired to obtain the foregoing points under various conditions.

The pupal notes likewise involve a description that is complete and a knowledge of the anatomy is necessary. Important post-embryonic changes are occurring within the pupa and much work has been done on this subject which is known as histogenesis. The length of the pupal stage varies from a

few days to many months, or even years. The Hessian fly has recently been noted as living over four years in the papurium, which fact has an important influence on the control of the species. The transformation from the pupa to the imago is an important phase in the insect's life economy.

Now the adult must be considered. Again a description should be given and thorough morphological and physiological studies made. The period from transformation to complete maturity differs in some forms. In ants there is an interpolated stage known as the callow, and in May flies a sub-imago stage. Color changes and other points can here be noted. The size of the insect may have a relation to the amount of food supply and this in turn may influence the duration of adult life. Weights and especially dimensions are useful in making taxonomic determinations. An average length of life should be computed under both natural and artificial conditions. Various foods may influence the duration and tests can be made with food and without water, also without food and with water.

Ability to distinguish the sexes is necessary and with some species this is hard to do superficially. The secondary sexual characters are used in this connection, and when lacking one must resort to the primary characters. The relation of size and color to sex is a point to note and the proportion of sexes has an important bearing. In Lachnosterna, the males predominate at lights during the spring flight, while a larger number of females are found on the food plants. With different insects, the proportion may vary at different seasons, so they should be observed for these data in the spring, summer, and fall, as well as during hibernation. Likewise, the sexes may vary during flights and under the influence of temperature conditions.

The number of generations may vary in a season, and the maximum, minimum, and average number of broods are important considerations. These again are determined by environmental conditions. The duration of the complete life cycle with its minimum, maximum, and average broods can then be summed up. With a tentative knowledge of the life cycle now at hand, the investigator is in a position to make a more thorough study of the life economy of the insect which involves consideration of the ecological features. To enumerate these would require too much time. However, a few of the following points should not go amiss. Habits of the species are ecologically important and require a knowledge of food plants, of what part, such as leaf, fruit, bud or root, is attacked, the susceptibility of different varieties of food plants, tests with other food plants and the occurrence on other than food plants; or, if parasitic, a knowledge of the hosts, prey and feeding habits of larva and adult. Temperature has its influence on feeding activity and may be the factor causing either nocturnal or diurnal feeding periods. Cannibalism as practised by some insects has a bearing on the method of rearing some species which must be kept separate in laboratory cages. The same is true of those with predaceous habits in either the larval or adult stage. The food plant investigations may suggest trap crops or other measures of control, such as clean culture.

Reproduction in insects is tremendous at times, and a knowledge of the processes of fertilization, polygamy, polyandry, and parthenogenesis are highly

important. The places of oviposition, the formation of the egg cavity, time required to deposit the egg, number of eggs deposited, dependence of oviposition on food supply, and the effect of oviposition on the plant, require careful observations and well-kept notes. These activities should be observed in the laboratory and field and differences noted. Other factors involved and perhaps influenced by the environment are the periods of first, last and maximum oviposition, as well as the rate or number of eggs laid daily.

Protection by mimicry is an ecological factor about which much can be written. Other methods of protection are found at all stages of various insects. The eggs may be protected by being deposited internally, by isolation, external structure, or protective secretions; larvæ and adults by places in which they develop, by external structures, such as spines, repellent odors, protective constructions (caddis flies) and protective excretions. Habit sometimes offers protection, and we find strong fliers, swift runners and active swimmers. Coloration involves mimicry and warning coloration, both of which afford protection. The pupa, to shield itself, may hide, construct cocoons and earthen cells, roll leaves, form galls, or be protectively colored. All these are important in life history investigations.

Theoretically, the annual progeny of a single pair should be computed and the number of individuals per acre should be estimated on a basis of field counts. The rate of multiplication is directly influenced by the available food supply which places restrictions on the numbers present.

Seasonal history is important and such factors as hibernation and æstivation must be considered. The time of entrance into hibernation is affected by temperature which in some species determines whether entrance shall be gradual or sudden. Different species have different stages passing the winter. The individuals may be congregated or found singly and this may be a factor affecting mortality at the time of entering hibernation. There is also mortality during and at the time of emergence from hibernation. The time of emergence from hibernation, like the period of entrance, is influenced by climate conditions and it may be abrupt or gradual. Sometimes re-hibernation occurs. The number and percentages of individuals entering and surviving hibernation ought to be observed. The finding of food in the spring is an important problem for the individual and one can determine the nature of the first food supply, the preferred food, how far they will go for it, and the duration of life of hibernating individuals. All these factors influence the relative abundance of the species and the amount of damage they are capable of doing in the spring. The abundance of pests that did so much damage in Kansas during the spring of 1921 can be traced to the mildness of the preceding winter which caused little mortality in hibernation.

The progress of infestation during the season should be followed and such points as the time and effect of the maximum infestation and percentage of the crop destroyed should be noted. Nothing has so far been said of parasites, predaceous enemies, and fungous diseases. These should all be studied.

The following list will serve to show the number of points of attack that may be studied to work out control measures; under natural control we have cannibalism, adverse climatic conditions, fungous and bacterial diseases, parasites, and predatory enemies; and, under artificial control, traps (trap crops, lights, shelters, and trap rows), insecticides, repellents, certain types of farm machinery, restriction of spreading by quarantine, disinfection and fumigation, and cultural methods of control.

Another desired feature is experimental farm work involving a sufficient knowledge of farming methods to conduct time of planting tests, variety, fertilization, cultivation, soil and isolation tests as applied to insect control. Obviously, the investigator should have a broad fundamental training and his time and available funds should be guarded against wasted energy.

A PARTHENOGENETIC MAYFLY (*AMELETUS LUDENS* NEEDHAM).

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The female subimago and nymph of *Ameletus ludens* was described by Needham (1905) from material taken at Newport, N.Y. The nymph of this mayfly is a small brook-inhabiting form which occurs very abundantly in the many small brooks in the vicinity of Ithaca, N.Y. At the season of emergence the female subimagoes and imagoes are not uncommon along the banks of these brooks. A suggestion that reproduction in *Ameletus ludens* might be a case of parthenogenesis was made by Morgan (1911) who recorded unsuccessful efforts to find the male of the species in spite of extended and diligent search. In order to test out this suggestion the writer had this species under more or less constant observation from June 14, 1913, to July 30, 1915.

From June 14 to June 30, 1913, only a few mature nymphs were found in the brooks and no adults were observed. Apparently the period of emergence was practically over since in early July no nymphs could be located. By the middle of August the brooks had ceased to flow, there being only an occasional stagnant pool or some slight dampness and stretches where no trace of moisture was evident.

On April 18, 1914, almost mature nymphs were abundant and on April 27 a male subimago was discovered resting on the surface of the water having just emerged. A short distance away a female subimago was also located. These were both taken to the laboratory and placed in wire cages but unfortunately the male failed to transform. No other male has been found although much time has been spent along the streams in search, hundreds of nymphs have been examined and many subimagoes reared. Females were fairly abundant during this year up to the middle of June and mature nymphs could be found up to about June 30 as in the preceding year. Again the streams were practically dry during midsummer.

On May 6, and again on May 8, 1914, eggs were dissected from reared females, placed in water in petrie dishes and kept in the laboratory. The water in the dishes was changed usually every other day. Fertilization could not have occured by any chance since all the nymphs were examined before being placed in the rearing cages. (The sexes can be distinguished in mature mayfly nymphs by the size of the eyes and by the rudimentary genitalia). All the subimagoes which emerged were females and these were transferred to wire cages. The adults used in this experiment were dissected about 24 hours after the subimaginal moult. On October 5 a newly hatched nymph was found in one of the petrie dishes and examination of the eggs showed moving embryos. Hatching continued for over a week. The period of incubation was thus almost exactly 5 months. No record of the temperature changes in the laboratory was kept during this time except that on September 1 and 2 the air temperature was 28.3 C. and again on September 11 it was 15.5 C.

Fertilized eggs of other species of mayflies were kept during this summer at the fish hatchery in Cascadilla gorge where the air temperature was considerably lower and these hatched as follows: *Hexagenia bilineata* 29-40 days; *Hexagenia recurvata* 14 days; *Ephemera varia* 15 days; *Heptagenia tripunctata* 11-23 days; *Ecdyurus maculipennis* 12 days.

The long period of incubation in the case of *Ameletus ludens* may be a characteristic which has made possible the existence of this species in brooks which are subject to mid-summer droughts. The presence of a thickened roughened coat on the egg would appear to support this belief. The egg is figured by Morgan (1913).

The seasonal history for 1915 was much the same as in the two previous years. Nymphs 4 to 7 mm. were abundant in January. Mature nymphs were present in large numbers toward the end of April. On April 27 many emergings took place and one female was observed ovipositing at 8.30 a.m. By June 7 only a few nymphs remained in the brooks and no adults were observed.

These results show conclusively that *Ameletus ludens* reproduces parthenogenetically. The finding of the single male indicates that the evolution toward complete parthenogenesis is not yet complete and that sexual reproduction probably occurs in very rare instances. Whether or not this parthenogenetic condition of *Ameletus ludens* is of local or general occurrence cannot be said at the present time.

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ANNOTATED LIST OF THE BUPRESTIDAE OF PENNSYLVANIA (COLEOPTERA).

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In the preparation of this list of *Buprestidae,* which is arranged according to Leng's Catalogue*, a number of original rearing and collecting records and observations have been utilized, to which have been added records from several private and museum collections, and likewise those in the Pennsylvania State Collection. Various records in literature on this group, pertaining to Pennsylvania and adjacent states, have been included, since there is a strong possibility that several species recorded from nearby states occur here.

The work was carried on under the direction of Prof. J. G. Sanders, Director of the Bureau of Plant Industry. The author is also indebted to Dr. Henry Skinner and E. T. Cresson Jr. for the privilege of studying the Horn Collection in the Academy of Natural Sciences of Philadelphia, and to the following persons for valuable records and suggestions: Messrs. H. E. Burke, A. B. Champlain, E. M. Craighead, C. A. Frost, H. B. Kirk, H. G. Klages, F. R. Mason, A. S. Nicolay, H. B. Weiss and H. W. Wenzel.

Polycesta Sol.

P. angulosa Duv. (*obtusa* Lec.) Near Philadelphia (LeConte). A southern species which was probably imported in southern lumber.

Recorded as breeding on *Coccolobis laurifolia* in Florida.

Acmaeodera Esch.

A. ornata Fab. Mount Holly, June 22 (V. A. E. Daecke); Carlisle Junction, April 27 (A. B. Champlain); Darby (H. W. Wenzel).

A. pulchella Hbst. S. W. Penna. (Dr. Hamilton); Erie, July (H. G. Klages).

A. tubulus Fab. Common on flowers throughout the state in May and June. Recorded as breeding in hickory and white oak (*Quercus alba*). A. B. Champlain reared an adult from dead redbud (*Cercis canadensis*) collected at Rockville.

Ptosima Sol.

P. gibbicollis Say. Common where redbud (*Cercis canadensis*) occurs, in which tree the species breeds. The adults mature in the fall and pass the winter in their pupal cells.

Chalcophora Sol.

C. virginiensis Drury. Common throughout the pine section of the state, breeding in partly decayed stumps and trunks of both hard and soft pines.

C. fortis Lec. S. W. Penna. (Dr. Hamilton); Morris, June 20 (I. H. White); Endeavor, July 30 (Kirk and Knull); Charter Oak, June 18 (Author). Reared from dead white pine (*Pinus strobus*). Collected at Charter Oak.

C. liberta Germ. A common species which breeds in dead pine.

Chalcophorella Kerr.

C. campestris Say. A common species which has been recorded as

*Catalogue of the Coleoptera of North America, 1920.

breeding in dead sycamore (*Platanus occidentalis*), beech (*Fagus americana*), and willow (*Salix nigra*). The adults overwinter in their pupal cells.

Dicerca Esch.

D. divaricata Say. A common species, which breeds in the heartwood of a great variety of dead trees.

D. caudata Lec. North East, Aug. 8, Charter Oak, June 5 (E. M. Craighead); Harrisburg, Aug. 11 (H. B. Kirk); Cresco, June 9 (Author). Recorded in the literature as breeding in birch (*Betula nigra*).

D. prolongata Lec. S. W. Penna. (Dr. Hamilton); North East, June 9 (E. M. Craighead); Charter Oak, July (Author). Recorded as breeding in dead aspen (*Populus grandidentata*).

D. punctulata Sch. Breeds in dead pine and occurs throughout the pine sections of the state.

D. pugionata Germ. S. W. Penna. (Dr. Hamilton); Hummelstown, June 12 (Author); Charter Oak, July (Kirk and Knull). Recorded in the literature as breeding in living witch-hazel (*Hamamelis virginiana*), alder (*Alnus*) and *Spiraea opulifolia.*

D. obscura Fab. Breeds in the dead wood of persimmon (*Diospyros virginiana*), and can be found throughout the state where the host-plant occurs It is also recorded as breeding in dead staghorn sumac (*Rhus typhina*).

D. lurida Fab. A common species which has been recorded as breeding in hickory, blue beech (*Carpinus caroliniana*) and alder (*Alnus rugosa*).

D. lepida Lec. S. W. Penna. (Dr. Hamilton); Rockville, June 1 (A. B. Champlain); Hummelstown, July 11 to 29 (Author).

Recorded as breeding in dead ironwood (*Ostrya virginiana*). It was found breeding in the dead wood of hawthorn (*Crataegus coccinea*) at Charter Oak. Recorded by C. W. Stromberg as hibernating around the bases of hawthorn trees.

D. scobina Chev. Found in the fall, on the foliage of sour gum (*Nyssa sylvatica*) in the dead wood of which the insect breeds. The adults hibernate, and can often be found through the winter months.

D. americana Hbst. Pittsburgh (H. G. Klages); Rockville, Dec., under loose bark (A. S. Koser); Delaware Co., July 12 (H. W. Wenzel); Dec. 13, Jan. 9, State College (Author).

D. tenebrosa Kirby. Recorded from New York State, and probably will occur in Penna.

D. tuberculata C. & G. S. W. Penna. (Dr. Hamilton); North East, Sept. 2 (E. M. Craighead); Hummelstown, July 9 (Author); ovipositing in a hemlock (*Tsuga canadensis*) log at Charter Oak, on June 22. Adults emerged from injuries on living hemlocks at Montebello in July and August. The insect breeds in the dry wood around the injuries on living trees.

Poecilonota Esch.

P. cyanipes Say. S. W. Penna. (Dr. Hamilton); North East, Aug. 22 (E. M. Craighead); Milford, June 6 (H. B. Kirk); Charter Oak, July 8 (Author). Recorded as breeding in large-toothed aspen (*Populus grandidentata*).

P. thureura Say*. This species was found breeding in living willow

at Harrisburg by A. B. Champlain and the author.

The egg is laid on the trunk of the living tree, and the larva, working between the inner bark and outer sapwood, does not travel through the infested tree, but remains at the point where the egg was laid. The rapid growth of the tree furnishes sufficient nourishment. Upon reaching maturity a pupal cell is formed between these two layers, which is surrounded by frass, and very much resembles the pupal cell of *Rhagium lineatum*. The life history extends over at least two years, since very small larvae, together with mature larvae, were found in the infested trees during the winter months. Adults were reared from May 26 to May 30.

Cinyra C. & G.

C. gracilipes Melsh. S. W. Penna. (Dr. Hamilton); Harrisburg, June (Kirk and Champlain); Hummelstown, May and June (Author). Recorded as breeding in white oak (*Quercus alba*); swamp white oak (*Quercus bicolor*); and ironwood (*Ostrya virginiana*).

Buprestis Linn.

B. sulcicollis Lec. This species has been recorded from New York State, and probably will occur in Pennsylvania.

B. striata Fab. Found throughout the pine sections of the state. The adults which appear in the spring, having matured the previous fall, pass the winter in their pupal cells. The species breeds in hard and soft pines, although it was found working in a scar on a living hemlock (*Tsuga canadensis*) at Hummelstown, and an adult was reared April 1.

B. striata var. *impedita* Say. This color variety occurs with the preceding.

B. apricans Hbst. Frankford, July 18 (P. Nell); Tidioute (F. L. Holdridge). A southern pine species which probably has been imported in lumber.

B. decora Fab. Philadelphia, May 10 (H. W. Wenzel). A southern species which probably has been brought into the state in lumber.

B. salisburyensis Hbst. S. W. Penna. (Dr. Hamilton); Carlisle Junction, July 4, (A. B. Champlain); Hazleton, July (Dr. Dietz). Recorded in the literature as breeding in pine.

B. lineata Fab. Lehigh Gap, July 3 (G. M. Greene); Inglenook, April 18 (H. B. Kirk); Harrisburg, July 31 (Author). Recorded as breeding in dead pine. A. B. Champlain reared adults from the thick bark of dead pitch pine (*Pinus rigida*) collected at Hunters' Run.

B. maculipennis Gory. Charter Oak, July 9 (Kirk and Champlain); Rockville, July 8 (A. B. Champlain); Mt. Alto, Aug. 4 (Author).

The species usually breeds in dead limbs and branches of pine, although adults were reared July 21, from dead hemlock (*Tsuga canadensis*) collected at Montebello.

B. maculativentris Say. "Penna." (LeConte); Bethlehem (G. W. Caffrey); Milford, July. Recorded in the literature as breeding in pine.

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*Determined by W. J. Chamberlain. (Page 80.)

B. nuttali var. *consularis* Gory. Hunters' Run, July 11 (V. A. E. Daecke); Charter Oak, Aug. 12; Harrisburg, Sept. 30; Montebello, Aug. (Author). Recorded as breeding in dead pine.

B. rufipes Oliv. Found throughout the state, and recorded in the literature as breeding in dead American elm (*Ulmus americana*); sour gum (*Nyssa sylvatica*), beech (*Fagus americana*); chestnut (*Castanea dentata*), and hickory. A. B. Champlain found this species breeding in dead oak at Rockville.

B. fasciata Fab. S. W. Penna. (Dr. Hamilton); Endeavor, July 30 (Kirk and Knull); Harrisburg, July 22 (A. B. Champlain). Probably breeds in dead pine.

Xenorhipis Lec.

X. brendeli Lec. Crafton (E. A. and H. G. Klages); Philadelphia. Recorded in the literature as breeding in hickory.

Melanophila Esch.

M. acuicola Melsh. S. W. Penna. (H. G. Klages); Linglestown, June and July (Dr. D. M. Castle); Drumgold, June 1 (Author). Breeds in pine.

M. fulvoguttata Harris. Common throughout the state. It has been recorded in the literature as breeding in red spruce (*Picea rubens*), American larch (*Larix americana*) and hemlock (*Tsuga canadensis*).

M. drummondi Kirby. Recorded from New York State, and probably will occur in the state.

M. acuminata DeGeer. S. W. Penna. (Dr. Hamilton); Philadelphia (H. W. Wenzel). Recorded in the literature as breeding in pine, spruce and fir.

Anthaxia Esch.

A. viridifrons Gory. A common species recorded as breeding in hickory and elm.

A. aenogaster C. and G. Bethlehem (G. W. Caffrey).

A. viridicornis Say. S. W. Penna. (Dr. Hamilton); Harrisburg, May (Author). This species breeds in dead and dying willow in the vicinity of Harrisburg.

A. quercata Fab. S. W. Penna. (Dr. Hamilton); Charter Oak, July 9, Hummelstown, June (Author). Recorded in the literature as breeding in redbud (*Cersis canadensis*), *Crataegus coccinea*, white pine (*Pinus strobus*), grape, American larch (*Larix americana*) and chestnut.

Agrilaxia Kerr.

A. flavimana Gory. Philadelphia Neck, July (H. W. Wenzel); Hummelstown, June 6 (Author). Recorded in the literature as breeding in white oak and plum.

Chrysobothris Esch.

C. sexsignata Say. Common throughout the state and recorded in the literature as breeding in dead hemlock (*Tsuga canadensis*), black ash (*Fraxinus nigra*), white ash (*Fraxinus americana*), red maple (*Acer rubrum*), swamp white oak (*Quercus bicolor*), walnut (*Juglans nigra*), hickory, beech, birch, American larch (*Larix americana*), and the outer bark of living butternut (*Juglans cinerea*).

C. scitula Gory. Philadelphia Neck (H. W. Wenzel); Harrisburg, July 4 (Author). Probably breeds in oak.

C. lecontei Leng. Spring Mill, June 21 (F. M. Trimble); Harrisburg, July 4 (J. G. Sanders); Chestnut Hill, June 24 (J. K. Primm); Hummelstown, June and July (Author). Recorded in the literature as breeding in dead alder (*Alnus rugosa*) and swamp white oak (*Quercus bicolor*). Reared from dead sumac by A. B. Champlain and the author.

C. blanchardi Horn. Rockville, July 21 (A. B. Champlain); Endeavor, July 30, Charter Oak (Kirk and Knull). Recorded as breeding in dead pitch pine (*Pinus rigida*) bark. Adults were chopped from the sapwood of dead white pine (*Pinus strobus*) at Charter Oak.

C. pusilla C. & G. A common species which is recorded in the literature as breeding in spruce and pine. Adults were reared from hemlock (*Tsuga canadensis*) collected at Hummelstown.

C. trinervia Kirby. S. W. Penna. (Dr. Hamilton). Recorded in the literature as breeding in pine.

C. verdigripennis Frost. Montebello, July 7 to July 17 (Guyton and Knull). This species works in scars and injuries on living hemlock (*Tsuga canadensis*) trees in the vicinity of Montebello. An adult was observed ovipositing in an injury on July 7. The larvae work beneath the bark of the injured tree, and pupate in the sapwood.

C. dentipes Germ. The bettle breeds in dead pine, and is common throughout the state on pine slash. It has also been recorded in the literature as breeding in American larch (*Larix americana*).

C. floricola Gory. Breeds in dead pine and is common throughout the state.

C. femorata Oliv. One of our most common Buprestids and breeds in a large variety of dead and dying fruit and forest trees.

C. scabripennis C. & G. Rockville, June (Kirk and Champlain); Endeavor, July 30; Charter Oak, June 20 (Kirk and Knull). Breeds in dead white pine (*Pinus strobus*) and hemlock (*Tsuga canadensis*).

C. harrisi Hentz. Rockville, June 14 (A. B. Champlain); Charter Oak, June and July (Kirk, Champlain and Knull). Recorded as breeding in dead pine.

Actenodes Lec.

A. acornis Say. Jeannette, July (H. G. Klages); Chestnut Hill, June 24 (J. K. Primm); Charter Oak, July 10 (Champlain and Knull); Hummelstown, June and July (Author). Recorded as breeding in the dead wood of red maple (*Acer rubrum*), black birch (*Betula lenta*), beech (*Fagus americana*), black oak (*Quercus velutina*) and hickory.

Eupristocerus Deyr.

E. cogitans Web. Common throughout the state, and forms galls on the living stems of alder (*Alnus rugosa*) and (*A. incana*).

Agrilus Steph.

A. bilineatus Web. Common throughout the state, and breeds in dead and dying oak and chestnut.

A. bilineatus var. *azureus* n. var. This variety resembles *A. bilineatus* to such an extent that it is deemed necessary to merely give the differences. Elytra bright blue, void of the pubescent vittae on the elytra of *A. bilineatus*. On some specimens there is a faint trace of this strip near the humeral angle, and again near the apical angle of each elytron. Length 8 mm.

Adults of this variety, which may prove to be a distinct species, were collected on the foliage of blue beech (*Carpinus caroliniana*) at Philadelphia in June, by Messrs. F. M. Trimble and J. K. Primm. Later Mr. Primm sent several infested branches of living blue beech to the office of the Bureau of Plant Industry at Harrisburg. Adults emerged from June 1 to June 4.

The author has also reared it from blue beech collected at Hummelstown. The work of this variety was observed in living beech (*Fagus americana*) at Harrisburg by A. B. Champlain and the author, and a dead adult taken from the sapwood. The larvae mine underneath the bark in the living stick, and cause an abnormal swelling around the gallery. The pupal cells are formed in the sapwood.

Type in collection of author.

A. acutipennis Mann. Common throughout the state in June and July on oak foliage.

A. anxius Gory. A common species which has been recorded in the literature as breeding in birch, poplar and willow.

A. pensus Horn. Charter Oak, June 5 (Author).

A. ruficollis Fab. One of our most common *Agrilus* and breeds in the living stems of blackberry and raspberry, forming galls on the stems of infested plants.

A. lateralis Say. Adults of this species were collected on the foliage of sweet fern (*Comptonia peregrina*) at Bear Meadows, Huntingdon Co., on July 5, and a Cedar Run on July 12. The number of adults taken indicated that this plant was the host of the species. An examination showed that *Agrilus* larvae were working in the stems of the living plants.

A. B. Champlain informs me that he had reared a number of adults from the stems of bayberry (*Myrica carolinensis*) at Lyme, Conn. The larvae work in the living stems of the bayberry, causing abnormal swellings. It has been recorded by M. P. Somes as breeding in apple twigs.

A. masculinus Horn. Harrisburg, May 31 to June 3; Charter Oak, June (Author). Adults were reared from the sapwood of dead box elder (*Acer negundo*) and red maple (*Acer rubrum*).

A. pusillus Say. S. W. Penna. (H. G. Klages); Hummelstown, June 12 (Author).

A. frosti Knull. Charter Oak, June 21 (Kirk and Knull); Harrisburg, May 24; Chambersburg, June 6; Hummelstown, June 2 (Author); Berks Co., June 1.

A. defectus Lec. May, June, Hummelstown (Author). Recorded as breeding in white oak (*Quercus alba*).

A. cinicornis Horn. Jeannette (H. G. Klages); Duncannon, June 24 (J. G. Sanders); Charter Oak, June 21; Hummelstown, May and June (Author).

A. egenus Gory. Common throughout the state, and recorded as breeding in locust (*Robinia pseudacacia*).

A. celti Knull. Hummelstown, May and June (Kirk and Knull).

A. cephalicus Lec. York, Reading, Harrisburg, Hummelstown. Reared from sapwood of dead dogwood (*Cornus florida*) (Author).

A. arcuatus Say. Found throughout the state and recorded as breeding in hickory, oak and beech (*Fagus americana*). The larvae prune branches from infested trees.

A. coryli Horn. Found throughout the state where Hazelnut (*Corylus*) occurs. This species has been classed as a variety of *A. arcuatus,* but the work of the two insects differs to such an extent that I have listed it as a distinct species. *A. arcuatus* girdles branches of various forest trees, and *A. coryli* breeds in living hazelnut (*Corylus*) forming galls on the infested stems.

A. B. Champlain informs me that the work of *A. coryli* is common on hazelnut in the vicinity of Lyme, Conn., and that the infested stems are not pruned, but galls are formed due to the circular borings of the larvae. The author has also observed the work in various parts of the state.

A. champlaini Frost. Drumgold (Sanders and Champlain); Charter Oak (A. B. Champlain); York Co., Cedar Run (Author). This species has been recorded as forming galls on living ironwood (*Ostrya virginiana*). The larva pupates head down in the center of the gall, and emerges from the lower part of the swelling.

A. imbellis Cr. Recorded from New Jersey, and probably will occur in the state.

A. fallax Say. S. W. Penna. (Dr. Hamilton); New Cumberland (H. B. Kirk); Rockville (Champlain and Knull). Recorded in the literature as breeding in honey locust (*Gleditsia triacanthos*) and hackberry (*Celtis occidentalis*).

A. subcinctus Gory. S. W. Penna. (Dr. Hamilton); Pittsburg, June 19 (H. G. Klages); Hummelstown, June 2 (Author). Probably breeds in poison ivy (*Rhus toxicodendron*).

A. putillus Say. Jeannette, June (H. G. Klages); Hummelstown, June 17; Charter Oak, June 22.

A. otiosus Say. Common throughout the state, and breeds in dead hickory.

A. juglandis Knull. Found throughout the state, and breeds in the outer bark of living butternut (*Juglans cinerea*).

A. sinuatus Oliv. An imported species which has been recorded from New York and New Jersey, and is sure to occur in Pennsylvania.

A. crataegi Frost. Harrisburg, June 7 and June 12 (Champlain and Knull); Charter Oak, June 22 (Author). Recorded in the literature as breeding in *Crataegus.*

A. politus Say. Common throughout the state, and recorded as breeding in striped maple (*Acer pennsylvanicum*) and willow.

A. viridis var. *fagi* Ratz. This is a European species which has been introduced into the state. Adults were reared from June 6 to 11 from living rose (*Rosa rugosa*) stems, collected at West Chester by F. M. Trimble. The

larvae form galls, or abnormal swellings on the infested stems, often killing them. Mr. Trimble found the insect doing damage to nursery stock at Erie and Girard. E. M. Craighead collected adults on wild rose (*Rosa carolina*) in July on Presque Isle. Later Mr. Craighead and the author found numerous rose plants on the island which had been killed.

A. obsoletoguttatus Gory. Common throughout the state, and recorded as breeding in blue beech (*Carpinus caroliniana*), ironwood (*Ostrya virginiana*), red oak (*Quercus rubra*), beech (*Fagus americana*) and hickory. At Harrisburg beech branches were observed which had been pulverized by the larvae of this insect. Also reared from dead birch (*Betula lenta*) collected at Mechanicsburg.

A. vittaticollis Rand. S. W. Penna. (Dr. Hamilton); Endeavor, July 30 (Kirk and Knull); Charter Oak, June 20 (Kirk, Champlain and Knull); Hummelstown (Author). Recorded as breeding in *Crataegus,* shad bush (*Amelanchier canadensis*), apple, pear and wild crab.

A. granulatus Say. S. W. Penna. (Dr. Hamilton); Marysville, June 30 (V. A. E. Daecke). Reared from May 22 to 28 from the sapwood of dead willow collected at Harrisburg by A. B. Champlain and the author. Recorded as breeding in Lombardy poplar (*Populus nigra* var. *italica*) and cottonwood (*Populus deltoides*).

A. lecontei Saund. A common species, and breeds in the dead branches of hackberry (*Celtis occidentalis*).

Rhaeboscelis Chev.

R. tenuis Lec. Angora, June 15 (G. M. Greene); Philadelphia, July; Lester, June 5 (H. W. Wenzel). Recorded as breeding in the swamp rose-mallow (*Hibiscus moscheutos*).

Pachyschelus Sol.

P. purpureus Say. Wawa, May 25 (V. A. E. Daecke).

P. laevigatus Say. Common throughout the state, and recorded as breeding in the leaves of *Lespedeza virginica, Meibomia obtusa* and *M. virdiflora.*

Brachys Sol.

B. tesselatus Fab. S. W. Penna. (Dr. Hamilton).

B. terminans C. & G. Common throughout the state.

B. aeruginosus Gory. S. W. Penna. (Dr. Hamilton); North East, June 9 (D. M. DeLong); Philadelphia, July 14 (H. W. Wenzel); Hummelstown, June 9 (Author).

B. ovatus Web. Common throughout the state.

B. lugubris Lec. Hunters' Run, July 11.

Taphrocerus Sol.

T. gracilis Say. Common throughout the state on grass and vegetation in swampy places.

Mastogenius Sol.

M. subcyaneus Lec. S. W. Penna. (Dr. Hamilton); Philadelphia, June and July (H. W. Wenzel). Recorded in the literature as breeding in dead oak branches.

THE REDISCOVERY OF *ODYNERUS* (*ANCISTROCERUS*) *WALDENII* VIERECK (HYMENOPTERA)

BY E. J. SMITH,
Sherborn, Mass.

In Vol. XVII, Oct., 1906, p. 304 of Entomological News Mr. H. L. Viereck describes a new species of Odynerus under the name of *O. waldonii.* In the next issue, Nov., 1906, p. 350, this spelling is corrected to read *waldenii,* the former spelling being a typographical error.

As I have been for some years interested in the Vespoidea I have got together quite a good series of most of our wasps of that family, and in looking them over I found that I evidently had two species mixed under the name of *albophaleratus*, and in trying to identify them from the keys in Bulletin 22, Conn. Geol. and Nat. Hist. Survey, I found that one was *albophaleratus,* while the other one ran directly to *waldeni* (as spelt there); but as the key stated that only one specimen was known I naturally felt some doubt as to whether my wasps could really be that species.

At that time I was corresponding with Dr. Joseph Bequaert at the American Museum of Natural History at New York and I sent him a specimen and asked his opinion. He replied that although he had several similar specimens in his collection he had never definitely identified them, but would look the matter up and let me know later. Some time afterwards he wrote, "I have now been able to examine the type specimen of *waldenii* Vier. and find it agrees perfectly with the specimen sent by you as being doubtfully that species. The white dot at apex of abdomen is present, though not mentioned in the description."

The species may be briefly described as follows: color, markings and general appearance very similar to *albophaleratus*, but stouter bodied, and in this respect more like *birenimaculatus.* Scutellum with variable spots. On two of my specimens the spots are large and square, and confluent, as is often the case in *birenimaculatus,* and in others the spots are smaller and well separated. Most of the specimens have a small dot on each side of postscutellum, one has a continuous band, and in two instances the postscutellum is wholly black. But the most conspicuous mark of distinction between this species and *albophaleratus* is a white blotch on dorsum of last abdominal segment. This I have never found in *albophaleratus,* but is present in the ♀ of *birenimaculatus.* One specimen has a white dot on each side of second segment. The clypeus is very variable, in some specimens it is largely white, while in others the black predominates. One specimen, which was dug out of a decaying stump by Mr. C. A. Frost while searching for coleoptera on May 15th, 1921, differs from the rest in having only the merest trace of spots on each side of scutellum, and none on the postscutellum. My specimens are all females, and dated as follows: June 17, 1917, June 5, 8, 15, 1918, Aug. 7, 15, 1919. Locality, Sherborn, Mass. One sp. Framingham, Mass. V. 15, 21, C. A. Frost. The date of the one sent to Dr. Bequaert was not noted. Eight specimens in all. Most of mine were taken on flowers of syringa. There are also several other specimens in the collections of Mr. A. P. Morse, of Wellesley, and in the Boston Society of Natural History. From the wide difference in dates of capture it would seem that this species (like most of the Odynerri) is double brooded. I have no authentic male.

THREE NEW SPECIES OF PARASYNTORMON WITH A TABLE OF SPECIES. (DOLICHOPODIDAE, DIPTERA).

BY M. C. VANDUZEE,

Buffalo, N. Y.

TABLE OF MALES.

1. Arista apical or nearly so .....2.
   Arista distinctly dorsal, although sometimes placed at apical fourth of third antennal joint .....7.
2. Third antennal joint about twice as long as the height of the head. (Mexico) .....*wheeleri* Aldrich.
   Third antennal joint about as long as the height of the head, or shorter ....3.
3. First antennal joint more or less yellowish white below (California) .....*lagotis* Wheeler.
   Antennæ wholly black .....4.
4. Arista distinctly subapical, fully half as long as third antennal joint, (Wyoming) .....*hinnulus* Wheeler.
   Arista wholly apical, about one fifth as long as the third joint .....5.
5. Third antennal joint nearly evenly rounded below, (California; Colorado) .....*asellus* Wheeler.
   Third antennal joint but little narrowed before its middle, where there is a small offset below, from which point it rapidly tapers to a point .....6.
6. Fore coxæ and femora largely blackish (California) .*fraterculus* new species.
   Fore coxæ and femora pale yellow, (California) .....*mulinum* new species.
7. Arista inserted near apical fourth of third antennal joint .....8.
   Arista inserted at or before the middle of the third antennal joint .....9.
8. Third antennal joint with a small offset at insertion of arista both above and below, (California) .....*emarginatum* Wheeler.
   Third antennal joint evenly rounded below, not notched above, (California) ..... *lepus* VanDuzee.
9. Arista twice as long as the third antennal joint, which is subquadrate, (Wyoming; Utah; Nevada) ..... *occidentale* Aldrich,
   Arista not or but little longer than the antenna .....10.
10. Third antennal joint large, obliquely truncate at tip, (Wyoming; California) .....*montivagum* Wheeler.
    Third antennal joint gradually tapering from near its base to an acute point, (California) .....*flavicoxa* new species.

Parasyntormon fraterculus n. sp.

Male: Length 2 mm. Face narrow, brown with a little white pollen at lower edge. Palpi brown. Proboscis yellowish brown. Front a little green. Antennæ black; third joint about as long as the height of the head, basal half of nearly equal width, at the middle of lower edge there is a slight offset, from which point it tapers rapidly to a point; arista apical, about one fifth as long as the third antennal joint; second joint lapping over the third about one fifth of the length of the latter.

Thorax and scutellum bronze green, dulled with gray pollen. Abdomen more coppery, without yellow even on the venter. Hypopygium shining black

with a few short stiff bristles; outer lamellæ narrow, brownish, fringed with long black hairs; inner appendages even more conspicuous, consisting of a pair of black halter-like organs with the knob somewhat obcordate.

All coxæ black with their tips narrowly yellowish; fore and middle femora blackish on basal half or more; posterior pair blackish above, yellowish on lower half. The anterior ones have the usual row of rather long delicate black hairs below. Fore and middle tibiæ and basitarsi dark yellow; posterior tibiæ and tarsi almost wholly infuscated. Fore tarsi black from the tip of first joint; first joint with the usual three bristles below on basal half; second joint swollen as in all the species of the genus. Middle tarsi almost wholly infuscated. Hind tarsi with the second and third joints of nearly equal length, first shorter. Calypters and halteres yellow, the cilia of the former black, at least in most lights.

Wings uniformly tinged with brown; fourth vein parallel with third, ending in the apex of the wing; last section of fifth vein fully three times as long as the cross-vein; anal angle prominent.

Described from one male which I took at Watts, Los Angles Co., Calif., April 1, 1915. Type in the authors collection.

Parasyntormon mulinum n. sp.

Male: This agrees with *fraterculus* in size, the color of head and thorax and in the form of the antennæ.

The abdomen is bronze green, the venter and sides of the second and third segments yellow. Hypopygium small, black with a few short blunt bristles; the outer lamellæ are yellowish brown, rather narrow, fringed all around with black hairs; I cannot see any inner appendages.

Fore coxæ yellow, middle and hind ones mostly black, their tips yellow. Femora and tibiæ yellow, tips of the posterior femora brownish. Fore tarsi black from the tip of the first joint, which has four bristles on the lower edge of basal half; second joint incrassated as usual in this genus. Middle and hind tarsi mostly brownish black, the latter with the first and third joints about equal in length, second joint longer. Calypters yellow with black tips and cilia. Halteres yellow. Wings about as in *fraterculus*.

Described from one male which I took at Carrizo Creek, San Diego Co., California, April 17, 1915. Type in the author's collection.

Parasyntormon flavicoxa n. sp.

Male: Length 3 mm. Face white, very narrow, the eyes almost touching below. Front blackish. Palpi white, small. Proboscis yellow. Antennæ black; third joint about as long as the face, which is also long, they taper to an acute point and are slightly notched where the arista is inserted at about its basal third. Arista a little longer than the antennæ.

Thorax green, dulled with brownish gray pollen. Abdomen dark green, the venter on second to fourth segments yellow, this color extends on to the dorsum on the second and third segments; the hairs of the abdomen are yellowish. Hypopygium rather large for the genus, blackish; its lamellæ small, narrow, fringed with hairs on the edges; the inner appendages are a pair of rather long yellow organs, which are enlarged at tip where there are several stiff hairs, on the side of their stem is a short blunt branch with two hairs at tip.

All coxæ, femora, tibiæ and basitarsi pale yellow; tips of hind femora brown above; the usual row of bristles on the lower edge of fore femora are yellow, still they appear brown or black in certain lights. Fore basitarsus with four bristles below on basal half; second joint enlarged as usual in this genus. Middle tibiæ with row of delicate black hairs on apical half of lower surface, which are as long as the diameter of the tibia. Middle tarsi infuscated from the base of second joint, hind ones almost to the base of first joint; first and third joints of hind tarsi of equal length, second joint longer. Calypters pale yellow with black tips, their cilia yellow, appearing brown in certain lights.

Wings dark grayish; they seem to be formed about as usual in the genus but are folded so as to make it difficult to see details.

Described from one male, which I took at Berkeley, California, May 23, 1915. Type in the author's collection.

MICROLEPIDOPTERA : NOTES AND NEW SPECIES.

BY ANNETTE F. BRAUN.

Cincinnati, Ohio.

Marmara fraxinicola n. sp.

Maxillary palpi white inwardly, black outwardly; labial palpi white, outer side of second segment and a spot near tip of third segment black. Antennae white, pecten black. Head, thorax and fore wings shining white. At extreme base of costa, a small brown spot, outwardly margined with dark brown scales; immediately following it, and connected with it by minute brown dusting is a large spot reaching to the fold, with a few scattered brown scales below the fold, dark margined outwardly and on the costa inwardly. Just before middle of wing a brown fascia, angulated on the fold, and narrowing beneath it, sometimes only the dark brown margin reaching the dorsum. At two-thirds an oblique fascia, forked below costa, the inner fork indistinct and continued in a line to the dorsum, the outer fork convex and curving to dorsum at tornus; between here and the apex, an oblique slightly curved fascia. A minute brown apical spot, lying in the angle between two oblique brown lines running into the white cilia on either side of the apex; a brown line through base of apical cilia between these two oblique lines. Hind wings and cilia dark brown, concolorous with dark brown margins of the fasciae. Legs white, anterior and middle femora brown, hind legs with oblique brown streaks. Expanse : 8.5 mm.

Type (♀) in the writer's collection; Cincinnati, Ohio, May 13.

The larva is a miner in twigs of white ash (*Fraxinus americana*). The larva begins its work in the new growth, and finishes mining in March and April of the following year. The mine is extremely long and is rarely found except on saplings or in rapidly growing shoots. Pupation takes place about the last of April, in an elevated fold of the bark at the end of the mine.

This species is distinguished from its nearest allies (*fulgidella* Clem. and *clotella* Busck) by the dark brown lustreless hind wings, and by details of the wing markings.

Marmara auratella Braun.

Braun, Can. Ent., XLVII, 193, 1915.

The two specimens from which this species was originally described were reared from mines on the cultivated variety of *Rudbeckia laciniata*, and careful search since has failed to disclose any more mines on this plant; however a number of specimens have been reared from year to year from mines on the stalks of Dahlias in cultivation. If *Dahlia* is the original food plant, as seems probable, the species is of Mexican origin, and its survival in northern latitudes due to the habit of a large proportion of the larvae of pupating very near to the base of the stem. When several inches of stem are stored with the roots, these pupae are preserved. Pupae in stems cut off and left out-of-doors during the winter do not survive.

Parectopa occulta n. sp.

Maxillary palpi white inwardly, black outwardly; labial palpi white, outer side of second segment towards apex and extreme tip of third segment blackish. Antennae black, anterior edge for about half the length white. Head and middle of thorax white. Sides of thorax and fore wings dark brown; a faint golden tinge in apical third of wings. Five white costal streaks and a broad white stripe along the dorsal margin from base to tornus. Upper edge of dorsal stripe just below fold somewhat undulating and beyond its middle sending a short pointed oblique projection to the fold; at the end of the white stripe a similar slightly longer projection nearly meets the end of the very oblique narrow white first costal streak starting at the basal fourth. The second costal streak just beyond the long oblique streak is very short and scarcely defined, sometimes almost obliterated; the third, oblique, reaches to the middle of the wing; the fourth, less oblique, passes entirely across the wing to the termen, and is white on the margins, silvery in the middle; the fifth partially encloses the apex, in which there is a velvety brown spot; a dark brown line in apical cilia and a brown ciliary hook. Beyond the end of the dorsal white stripe a small triangular white spot, and between it and the end of the long oblique first costal a short obliquely placed silvery bar. Hind wings and cilia dark fuscous. Legs white, obliquely barred with dark brown. Underside of body silvery. Expanse : 9 mm.

Type (♂), *Paratype* (♂), in the writer's collection; Powell County, Kentucky; imagines July 12.

The larvae collected June 26, mine leaves of vetch (*Vicia caroliniana*) forming irregular somewhat digitate greenish mines starting over the midrib, where the mine is whitish. Cocoon papery, in a fold of the leaf.

Closely allied to *P. salicifoliella* Clemens and *P. thermopsella* Chambers; it differs from the former by the longer more distinct white costal streaks, and shorter more indented white dorsal stripe; from the latter chiefly by the different lengths of the costal streaks and the nearly obsolete second costal streak.

Gracilaria murtfeldtella Busck.

Busck, Proc. U. S. N. M., XXVII, 771, 1904; Ely, Proc. Ent. Soc. Wash., XIX, 76, 1917.

The gall-producing habit of this species is unique in the genus *Gracilaria*; accompanying this feature are also some peculiarities in larval structure, cocoon

and imaginal habits. In imaginal structure, however, the species does not differ from other members of its genus.

The oval elongate stem gall, which resembles that of *Gnorimoschema gallaesolidaginis,* but is somewhat more elongate, is found on the stem of *Pentstemon laevigatus*, rarely on *Pentstemon hirsutus*, and, judging from the wide distribution of the moth, on other species of *Pentstemon* elsewhere. It may be situated at the extreme base of the stem, just above the surface of the ground, or several inches up the stem; in the latter case, the gall is more symmetrical. The presence of the gall in some way aborts the development of the shoot, as no instance was observed in which gall-bearing stems produced blossoms, although these stems were ones which normally would have bloomed. An examination of stems bearing galls showed indications of a mine running down from the tip of the shoot through the center of the stem; this would seem to indicate that the egg is deposited, presumably in the autumn or early spring, in the center of the rosette and that the larva upon beginning to mine destroys the growing tip of the shoot. The gall has reached its full size in June, although the larva continues to feed during the greater part of the summer, pupation taking place about September 1 in the vicinity of Cincinnati.

The larva has three pair of thoracic legs well developed, but prolegs, except those of the last abdominal segment, are entirely lacking. On each abdominal segment except the last three, there is a pair of dorsal tubercles; faint indications of these are present on the thoracic segments.

At the time of pupation, the larva eats almost through the wall of the gall, leaving merely a semi-transparent circular window of whitish epidermis through which the pupa is thrust at emergence. The cocoon is of thin papery silk, attached to the wall of the gall below the exit hole. At its upper end it bends rather abruptly continuing as a tube leading to the opening. In cross-section, the cocoon is cylindrical. The imagines emerged from September 5 to 25.

The resting position of the imago is that characteristic of the genus; the antennae are folded backward along the middle of the wing. When disturbed, the moth does not twirl the antennae, as is usual in species of *Gracilaria,* but moves them up and down with a scarcely noticeable rotary motion—much as a long-horned locust; after a few such movements, it folds the antennae back along the middle of the wing.

Most of the reared specimens have a greater amount of the deep orange brown color than is indicated by the original description. This color forms longitudinal streaking, often leaving the yellow ground color below the fold only; the cilia below apex are orange brown.

About 80% of the larvae found in any given area are parasitized. In addition, the galls, especially the parasitized ones, are inhabited by the larvae of Hymenoptera (a saw fly in one instance) which were found at the ends of the gall and in the unswollen stem beyond; dipterous larvae are also found, embedded in the tissue of the outer walls of the gall.

Elachista radiantella n. sp.

Palpi silvery gray, dark brown outwardly; antennae dark brown, shading to silvery at tip in the female; face silvery gray, head above brown, with a faint

reddish luster. Thorax brown, with a more pronounced purplish red tinge; tip of mesothorax and a few scales at tips of patagia silvery. Fore wings deep shining golden brown, with pearly iridescent markings; an oblique fascia crossing almost at base of wing; a distinctly angulated fascia near middle of wing; at tornus a silvery spot, and beyond it on costa almost at apex of wing, a larger curved streak which extends nearly to termen below apex, and is somewhat dilated below costa. Tips of scales around apex very slightly darker than the ground color; cilia brown. Hind wings and cilia gray, with a faint reddish coppery luster, darker in the male. Legs dark brown, femora silvery gray; tips of segments and a broad band around middle of hind tibiae silvery. Expanse : 5.5 mm.

Type (♀), U. S. National Museum; one *Paratype* (♂), U. S. N. M.; one *Paratype* (♀) in the writer's collection; all reared on *Panicum* at Washington, D.C. by Mr. August Busck. Mine "transparent, white, irregularly elongate;" pupa "hanging head downward, attached at the anal end only;" no cocoon. Larvae collected July 8 and 9; pupae July 10; imagines emerged July 18 to 20.

The pupa is in general of the ovate, shining type, but with the lateral ridges more prominent than usual; the median ridge does not extend on to the thorax. A raised ridge along each side of dorsum of mesothorax, followed posteriorly by two pairs of tubercles, tubercles of the second pair small and close together at tip of mesothorax; a group of five irregularly shaped tubercles laterally; a short divided hood projecting over face; prominent tubercles on front of head. (Above description made from pupal skin).

Of the described species it resembles in markings most nearly the species described below; but is distinguished from it by the venation and details of markings. Vein 4 of the fore wing is absent; vein 4 of the hind wing absent.

Elachista solitaria n. sp.

Palpi silvery gray, blackish outwardly; antennae dark brown, thickened with scales; face dark silvery gray, shading to dark brown on the head posteriorly. Thorax silvery gray, except anterior border, which is dark brown. Fore wings very dark brown; a small silvery gray spot at base of costa not reaching below fold; a brilliant silvery slightly curved fascia just beyond one-third; at tornus, a narrow erect triangular spot; beyond it, almost at apex, a curved costal streak, dilated in the middle of the wing and extending almost to the tip. Cilia white opposite apex, dark brown elsewhere. Hind wings and cilia dark brown. Legs dark brown, femora, tips of segments and a band around middle of hind tibiae silvery. Expanse : 5 mm.

Type (♂), in the writer's collection; reared from a mine on *Panicum* sp., Powell County, Kentucky. Mine collected June 26; imago July 10.

The mine begins as a narrow thread running along the margin of the leaf to the tip, then turning and abruptly enlarging into a blotch, 30 mm. long and 8 mm. broad at its lower end. Pupa enclosed in a very thin, whitish, almost invisible cocoon.

The pupa resembles that of the preceding species, with which it agrees in general form and arrangement of tubercles and ridges, but from which it differs

chiefly in the following respects: lateral ridges of abdomen more prominent, lateral tubercles of mesothorax larger and more conspicuously projecting when the pupa is viewed from the dorsal side.

In venation, this species agrees with the figure given in Meyrick's Handbook.

This species and *E. radiantella* differ from the other silver-marked species by the more posterior position of the costal streak before apex, it being farther from the fascia than the fascia is from the base of the wing. From *E. radiantella* this species is at once distinguished by the difference in venation; the thickened antennae, color of thorax, absence of basal fascia and white cilia also characterize it.

Elachista praematurella Clemens.

Clemens, Proc. Acad. Nat. Sci. Phila., 172, 1860.
Syn. *cristatella* Chambers, Can. Ent., viii, 72, 1876; *albipalpella* Chambers, Jn. Cinn. Soc. Nat. Hist., iii, 294, 1880.

A large series of reared and captured specimens establishes the synonomy as given above. The form described as *praematurella* by Clemens is the usual one occurring throughout the year. The form *albapalpella* is found commonly in early spring, but occurs also rarely in later generations; in it the ground color of the basal half of the wing is grayish, the outer half nearly black, and the white fascia and spots are distinct. In the form *cristatella,* the fascia is very narrow, sometimes almost obsolete, and the ground color much paler, speckled black and white; the black patch of raised scales, exterior to the fascia near the dorsal margin, is most conspicuous in this form, while nearly concolorous with the wing in other varieties.

The larvae mine in a variety of grasses, among them Kentucky blue grass (*Poa pratensis*), *Hystrix, Elymus,* and *Agrostis;* pupa enclosed in an open meshwork cocoon. The lateral ridges of the abdomen in the pupa bear a series of sharp spine-like projections.

NEW AND LITTLE KNOWN CANADIAN SYRPHIDAE (DIPTERA)

BY C. HOWARD CURRAN,
Orillia, Ontario.

Asemosyrphus canadensis n. sp.

Face produced downwards and slightly forwards into a long cone; whole fly black, mostly shining; ocelli very widely separated.

Length 9 to 10 mm. *Male.* Face and front shining black, the sides of the face obscured by whitish yellow pollen, leaving a median stripe and the cheeks shining; front broadly covered with similar pollen on the lower half, except an arch above the antennae. Lower half of the face produced as in *Helophilus conostomus* Will., but produced only a little forward, with a long, slender, not prominent tubercle below the middle, above which it is shallowly concave, and below which it is almost straight to the tip of the oral margin; antennal prominence narrowly reddish above the antennae. Antennae shining black, tip of second joint and immediate base of third somewhat reddish; third joint opaque, whitish pubescent, subquadrate, slightly broader than long and slightly shorter than the second joint, but longer than the first; arista

bare, long, slender, tapering. Posterior orbits yellowish gray pollinose. Pile: on the face limited to the sides, fine and whitish, cheeks bare; front with pale yellow pile, but with a black band across the anterior ocellus; posterior orbits with whitish pile below and yellowish above. Dorsum of thorax shining blackish green; a moderately wide opaque black median stripe not quite reaching the scutellum and which usually has a very slender shining stripe in its middle; on each side of this a shining stripe, obsolete before the posterior quarter, wider than the median opaque stripe; on the outer side of this is a broad, opaque black stripe, which is expanded on the posterior quarter to join the median opaque stripe, is partly interrupted at the suture, and encloses a more or less distinct narrow shining stripe; near the sides is a very narrow opaque stripe on the posterior two-thirds, interrupted at the suture. The shining stripes appear to have a grayish tint in some lights. Pleura and scutellum shining blackish green, with pile of a paler yellowish color than that on the dorsum. Abdomen shining greenish black with a metallic reflection in some lights, the first segment slightly grayish; second segment with a large basal opaque black triangle, broadly separated from the lateral margin and apex; third segment with a small opaque roundish or oval spot before its middle, sometimes obsolete; abdomen elsewhere shining; no lighter markings. Pile of the abdomen pale yellowish, but across the disc on the posterior half of each segment with shorter black pile. Legs shining greenish black, tips of all the femora and narrow bases of tibiae reddish (in one specimen the bases of the tibiae are more broadly yellowish and there is also a yellowish band just before the middle); hind femora considerably enlarged, the greatest swelling near the middle; hind tibiae arcuate, not ending in a spur; all the tarsi golden pubescent beneath. Wings a little infuscated; veins reddish, but brownish apically, basal portion of 2–3 longitudinal vein with about seven bristles of a blackish or reddish brown color. Squamae pure whitish with white pile; halteres brownish yellow.

Holotype, ♂, Raddison, Sask., July 29, 1907, (Jas. Fletcher), in the Canadian National Collection, Ottawa.

Paratypes, 1 ♂, same data, 1 ♂, Kinistino, Sask., July 25, 1907, (T. N. Willing).

This species is very distinct from the only other species in the genus reported from Canada, *A. mexicanus* Macq., and is readily recognized by the absence of light abdominal markings and the conically produced face.

Helophilus bilinearis Will.

Occurred in company with the above but was more abundant on April 28th, becoming scarce a week later. It is apparently a slightly earlier species. About 30 specimens were taken, including five females.

It varies considerably. Specimens occur with only yellow triangles on the second segment, while others have, in addition, partial lunules on the third segment and the entire lateral margin yellow. The female very closely resembles *H. lunulatus* but may be distinguished as follows: The lunules on the third and fourth segments are more grayish and seldom even touch the lateral margins; the face is slightly shorter and less rounded on the lower half. The anterior legs are usually darker than in *lunulatus*.

Syrphus grossulariae melanis, n. var.

Female. Length, 12 to 13 mm. Similar to typical *S. grossulariae* but the abdominal bands are metallic greenish or greyish black, sometimes with an obscure reddish metallic reflection in certain lights (old specimens). The metallic bands are covered with pallid pile, almost whitish, and the femora are a little more extensively black at the bases.

Holotype, ♀, Orillia, Ont., Sept. 18, 1921, (C. H. Curran), in the Canadian National Collection.

Paratypes, 4 ♀s, Orillia, Ont., Sept. 17, 18, 19, 1921, and Orillia, no date. There is an additional specimen in the Canadian National Collection.

This variety shows a peculiarity I have not noticed in the typical species, in that it keeps its wings in motion, as do some species of *Villa* (Bombyliidae) while visiting flowers, and is easily mistaken for a species of that genus. Both the typical form and the variety seem to be equally common on Wild Aster in the vicinity of woods about Orillia. All the specimens taken this year were females.

OCCURRENCE OF *AGRILUS CŒRULEUS* ROSSI IN AMERICA

BY C. A. FROST,

Framingham, Mass.

Two specimens which do not seem to differ from my European material of this species have been sent me by Mr. L. G. Gentner of the Michigan Agricultural College. They were taken by Mr. Charles L. Fluke at Sturgeon Bay, Wisconsin, July 26, 1920. He reported them very abundant flying about over wild raspberry bushes.

On May 28, 1921, while sweeping weeds and grass in a most unpromising pasture in Sherborn, Mass., I was much surprised to find a specimen of this same beetle in my net. The occurrence in such widely separated localities is interesting and it is probable that other captures of this species have been made elsewhere without its recognition.

It might be mistaken for a bluish-green specimen of *politus* or the closely allied *burkei* Fisher, but an examination would disclose the median concavity of the head with the deepest part just above the clypeus, the sharp and deep emargination of the prosternal lobe which is limited at each side by an acute angulation, and that indefinable sculpture above, characteristic of several European species.

The identification is based on comparison with specimens labelled "Carniolia" and "Austr. inf.," "det. v. Krekich," which were received from Europe some years ago.

Marseul in his Monograph of the Buprestidae gives the habitat as France, Germany, Spain, Portugal and Italy, being nowhere rare. He states that it lives particularly on the oak and beech, but also on the birch and alder.

CORRECTION

On page 70, line 29, read *Chilosia ontario* for *chilosia rita*.

Mailed July 10th, 1922.

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POPULAR AND PRACTICAL ENTOMOLOGY

Beetles Injurious To Sunflowers In Manitoba

BY NORMAN CRIDDLE,

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It is one of the misfortunes of farming in a new country that the breaking up of the virgin sod has a detrimental effect upon the farmer's friends such as wild birds, while it encourages previously harmless insects to become farm pests. The breaking up of the sod naturally forces ground-loving birds to seek nesting sites elsewhere, while the planting of crops provides certain insects with an abundance of new food thus enabling them to multiply far beyond the bounds that were previously possible. We have examples of this in cutworms, grasshoppers and the Western Wheat-stem Sawfly which were brought into prominence through the growing of cereals. Newly introduced crops are always apt to encourage the spread of native insects that feed upon allied plants and for that reason the entomologist finds it desirable to study the life-habits of most native insects in order to be prepared should they spread to cultivated crops.

The recent adaption of sunflowers for fodder purposes has provided another instance in which hitherto harmless insects may be turned into pests. There are a number of wild sunflowers in Canada some of which are closely allied to the cultivated kinds and since the wild species have their insect enemies there is no reason why these should not spread to those under cultivation and so become of economic importance. Notes relating to several of these insects have been made from time to time some of which are now put together in order that sunflower growers may recognize the commoner beetles found attacking the plants involved.

The Sunflower-leaf Beetle (*Calligrapha exclamationis*).

This is a common and widespread beetle in Manitoba where it is found feeding upon the leaves of various species of wild sunflower. It appears to be exclusively a sunflower feeder and for that reason promises to become one of the most important insects affecting these plants. The beetle has already spread to cultivated sunflowers where it breeds as readily as it does upon wild kinds. The life-history of this insect, as worked out at the laboratory under field conditions, is given, with a description, below:

Eggs—The eggs are elongate-cylindrical about three times as long as wide and slightly tapering towards one end. They are moderately densely punctate so that spaces between the punctures form a net-like surface. Colour dull white or greenish turning to orange before hatching.

The eggs are deposited singly but frequently in rows of irregular formation. They are placed on the stems usually in natural grooves when such are

present, but they may also be found on the underside of leaves though in lesser numbers. Egg laying extends over a period of two or more weeks and it is probable that at least 200 eggs are deposited by a single female. In captivity one beetle laid 116 eggs but it is believed that she had deposited a number before being captured.

Larvae—The larvæ are pear-shaped, the head being the narrow end. They are smooth above with numerous transverse ridges terminating near the sides close to the spiracles and bordered below by a prominent, wrinkled, lateral fold and a less conspicuous one beneath it. Underside flattish containing numerous fine, short hairs; anal extremity prolonged forming a bifid process which aids locomotion. Legs well developed black at tips. Colour of head light brown with white hairs, body pale yellowish.

The larvæ are hump-backed when crawling. They are usually found clustered around the crown of the plant where they feed upon the newly forming leaves.

Pupae—Pupation takes place beneath the ground not far removed from the plants upon which the larvæ have fed.

Adult—Superficially resembling the Colorado Potato beetle but considerably smaller. Head reddish-brown; thorax in front and at sides pale cream, basal portion with a brown area extending from the sides at base in the form of a half circle; elytra pale cream with three narrow black stripes on each side extending almost to apex and a fourth branching from the third at base extending almost a third of the elytral length, with a dot behind it thus forming the exclamation mark from which the beetle gets its scientific name. Abdomen beneath black, thorax, legs and antennæ reddish.

Beetles appear from hibernation in June; eggs are laid late in the month the ovipositing period extending into July. Larvæ are present throughout the last named month and pupation takes place at various periods towards the end of it.

Both beetles and larvæ feed upon the leaves of sunflowers. In nature they are most frequently met with on perennial species such as *Helianthus giganteus* though they have been noted in numbers upon *H. annua petiolaris* also and from these have spread to cultivated species. There is but one generation of the insect in Manitoba.

Sprays similar to those used for potato beetles are quite effective against the Sunflower beetle.

The Sunflower-pith Beetle (*Mordellistina pustulata* Melsh.)

The larvæ of this beetle were first collected in the stems of Red-root Pigweed, *Amaranthus retroflexus*, which had prematurely died. Later my brother, Evelyn, discovered them hibernating in sunflower stems some of which they had severely riddled with their tunnels. The larvæ confine themselves largely to the pith but also injure the more woody parts; they occur most frequently near the base of the plant though any portion of the stem may be infested. Plants so injured present a stunted appearance and at times die outright.

Larva—The larva is a yellowish object with black jaws. It is easily recognized by the twelve prominent protuberances on the back of the middle

segments which look not unlike prolegs and which are used for locomotion. Several larvæ may infest a single stem and these remain within the plant until the following spring when they pupate and give rise to the beetles in June.

Adult—The adults are semi-wedge-shaped beetles, black with irregular patches of pale silky hairs. There are many species of *Mordellestuna* all very similar in general appearance and for that reason no effort is made to describe the one referred to above. Most of the species are found upon flowers and they skip flea-like when disturbed.

In addition to the beetles mentioned above, a weevil, *Desmoris constrictus* Say, is found feeding upon the blossoms of sunflower in some numbers, but whether it will become of economic importance remains to be seen.

IPS PINI SAY AS A PRIMARY PEST OF JACK PINE

BY S. A. GRAHAM,

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Although it has been generally established that *Ips pini* Say is normally a secondary insect and usually attacks only dead or dying trees, it is not uncommon to find statements in entomological literature to the effect that this insect is occasionally able to attack and kill healthy living trees. Such cases are, however, so very rare that an interesting occurrence of this sort which was observed in Itasca Park, during the summer of 1921, seems worthy of record.

The trees killed were young, rapidly growing Jack pine, *Pinus divaricata,* varying from two and one half to five inches in diameter on the stump, and healthy Norway pine, *Pinus resinosa* saplings, about fifteen years old. That these trees were in excellent health up to the time of attack was indicated by the fact that there was no slowing up of the growth previous to the attack of the beetles. The trees killed totaled ten in number, seven jack pines and three Norway pine saplings.

Each tree was very heavily infested from the surface of the ground almost to the top. The infestation was so heavy that there was not sufficient bark area available for the development of all the young brood, there being from ten to twenty nuptial chambers to the square foot of bark surface.

These trees were all infested by the first brood beetles, and must have been attacked simultaneously by a large swarm of the insects. Apparently the attack was concentrated upon the few trees killed since a careful examination of surrounding pines failed to show any signs that other trees had been attacked. Why the swarm should have concentrated upon these few trees is hard to understand as there was no apparent difference in situation, rate of growth, or any other factor which might explain the preference shown for these particular individuals.

Apparently the beetles were attracted to the place by the presence of two freshly cut pines. These fallen trees were very heavily infested with *Ips pini.* What probably happened was this. A large swarm of these beetles was attracted to the fresh logs. More beetles collected at the spot than could find

* Published with the approval of the director as Paper No. 313 of the Journal Series of the Minnesota Agricultural Experiment Station.

room in the fallen trees and therefore chose to enter the neighboring standing trees. Inasmuch as there was an abundance of fresh pine slash within a few hundred yards of the place it is rather remarkable that the beetles did not make their way to, and infest, these piles.

Another interesting feature was the fact that this small group of heavily infested standing trees was found by woodpeckers and a very large percentage of the developing brood and adults of the insects was destroyed. It is estimated that at least 90 per cent. of all the insects in the trees, both adult and larvæ, were destroyed by these birds. The occurrence illustrates well the part that these useful birds often play in the economy of the forest. It is not at all improbable that this small infestation might have spread and served as the nucleus for a considerable outbreak if it had not been for the timely arrival of the woodpeckers.

Although the cut trees, lying on the ground, which we have assumed were the bait attracting the swarm of beetles to the infested trees, were just as heavily infested as the standing trees, it is interesting to observe that the woodpeckers did not work at all on these trees. The birds apparently were not interested in trees lying on the ground.

The preceding account illustrates well the fact that considerable care must be exercised in the use of trap trees for the control of bark-beetles. The trap tree method of control has often been recommended and applied in Europe and, since American forest entomologists have had a tendency to adopt European methods of insect control as far as possible, the practice has frequently been recommended in this country. The theory is that the insects can be attracted to freshly deadened trees called trap trees. After these traps have been infested they can be destroyed thus materially reducing the number of insects in the forest. The presence of newly killed trees about freshly cut logs emphasizes the fact that, since trap trees apparently have a tendency to concentrate the beetles they must therefore be used only with the greatest caution.

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SYNONYMIC NOTES ON CATOCALA SPECIES.

BY J. H. MCDUNNOUGH,

Entomological Branch, Dept. of Agriculture, Ottawa.

In the Archiv fur Naturgeschichte 79 A (8), p. 64, 1914, Dr. E. Strand has seen fit to apply names to all the unnamed aberrations mentioned by Hampson in Volume XII of the Catalogue of the Lepidoptera Phalaenae of the British Museum.

As a certain proportion of these names relates to North American species and as the synonymy was not dealt with in Illustrations of North American species of the Genus *Catocala*, Barnes & McDunnough, 1917, the following notes may prove of interest.

C. insolabilis ab. *insolabilella* Strand. Based on Hampson's ab. 1 "♀ smaller, 66 mm.; the head, thorax and forewing much browner." The form in question cannot be satisfactorily determined without an examination of the British Museum specimen.

C. innubens ab. *innubenta* Strand. Based on the normal ♀; falls in any case to *hinda* Fch.

C. subnata ab. *subnatana* Strand. Based on the normal ♀, with black streak below cell. The name should be dropped.

C. neogama ab. *arizonae* Strand. Hampson's ab. 3. "Hind wing with the terminal band interrupted.—Arizona." Probably referable to *euphemia* Beut. which was not known to Hampson in nature.

C. electilis ab. *electilella* Strand. Ab. 1. "Fore wing without the black medial shade." Unknown to me. Probably based on a Mexican specimen.

C. briseis ab. *briseana* Strand. Ab. 1. "Fore wing with a patch before the angle of postmedial line and the postmedial area except at costa and inner margin nearly pure white."

This form is in distinction, according to Hampson, to the typical form, in which the postmedial area is rufous except at costa and inner margin. The greater or less amount of whitish scaling on this portion of the wing is very variable and often depends on the condition of the specimen, worn specimens being much whiter than fresh ones.

C. junctura ab. *arizonensis* Strand. Ab. 3. "Fore wing more variegated with white especially on costal half of inner area and on postmedial and terminal areas except towards inner margin.—Arizona."

C. junctura ab. *juncturana* Strand. Ab. 4. "Fore wing with the basal area and the inner area to subterminal line suffused with fuscous black.—Arizona."

C. junctura ab. *juncturella* Strand. Ab. 5. "Fore wing wholly suffused with black to the subterminal line.—Arizona."

The status of the above three aberrations cannot be definitely determined without an examination of the British Museum specimens. The first one is probably a form of *arizonae* which Hampson incorrectly treats as Ab. 2 of *junctura;* the last two may very readily prove to be forms of *aspasia* with black shading, such as is found in *sara* Fch.

C. ilia ab. *iliana* Strand. This name, based on specimens with white reniform, falls to *conspicua* Worth.

C. gracilis ab. *tela* Strand. Based on specimens with dark shade along inner margin. This is in reality the typical form and Strand's name falls

MISCELLANEOUS NOTES ON COLEOPTERA

BY A. B. CHAMPLAIN AND J. N. KNULL,
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The following miscellaneous notes on Coleoptera present facts and records that have accumulated in our file from rearings and field observations, made by the authors, or by others to whom due credit is given. Records without dates refer to material caged and reared in the laboratory.

Lymexylidae

Hylecoetus lugubris Say. Infests dying *Populus grandidentata* at Lyme, Connecticut. These tall poplars about seventy-five feet high with branches and foliage near the top were in deep woods. The dying trees are infested with *Hylecoetus lugubris* which overwinter in the larval stage in transverse galleries or mines in the sapwood. The larvae were very plentiful at the base, and up the main trunk twenty-five to thirty-five feet. The larvae are lemon yellow in color, armed with a caudal spine, and range in size up to twenty millimeters in length. The emergence hole is made leading from the main gallery by the larvae in the fall. Larvae, pupae and first adults were found in their cells in the sapwood on April 25. Adults taken flying on May 4.

Melittomma sericeum Harris. The adults of this interesting species are nocturnal. During the hot summer nights they may be found on the outer bark of dead oaks. Our specimens were taken at Harrisburg, Pa., June 26; July 6 and 23.

Buprestidae

Polycesta angulosa Duv. Found breeding in the heart-wood of dead *Coccolobis laurifolia* at Miami, Fla. Mature adults were chopped from their pupal cells on April 12.

Actenodes bellula Mann. A mature adult was chopped from the sapwood of a dead cypress (*Taxodium distichum*) at Paradise Key, Fla., on April 15. Adults were numerous on fire-killed *Lysiloma latisiliqua,* on the same date.

Melandryidae

Orchesia castanea Melsh. Hummelstown, Pa. Adults reared from dead water-soaked, down, elm limb.

Rushia longula (Lec.) Hunter's Run, Pa. Reared from *Pinus rigida.* Larvae work in sapwood of dead standing tree.

Enchodes sericea Hald. Rockville, Pa. Reared from partly decayed stump of *Liriodendron tulipifera.*

Serropalpus barbatus (Schall.) Throughout the Eastern United States this species lives in dying hemlock (*Tsuga canadensis*); in the western area it is found in other conifers, including *Abies.*

Dircaea quadrimaculata (Say). Hummelstown, Pa. Reared from dead decayed wood of *Liriodendron, Rhus, Salix,*—H. B. Kirk.

Phloeotrya voudoueri Muls. Rockville, Pa. Reared from dead, decayed *Betula lenta,*—H. B. Kirk.

Anobiidae

Eucrada humeralis (Melsh.) Westbury, N. Y. Adults common on dying white oak.

Oligomerus obtusus Lec. Identified by H. C. Fall, Harrisburg, Pa., April, May, June, July, reared from *Fagus americana.*

Trichodesma klagesi Fall. Lyme, Conn. Reared from dead, dry stems of *Benzoin aestivale.*

Trichodesma gibbosa (Say). Harrisburg, Pa. Reared from *Hicoria,* and sour gum (*Nyssa sylvatica*) Marsh.

Trypopitys sericeus (Say). Identified by H. C. Fall, Inglenook, Pa. Reared from dead, hard, dry *Kalmia latifolia.*

Xyletinus harrisi Fall. Harrisburg, Pa. Reared from dead oak, July 12.

Xyletinus sp. near *X. fuscatus* Lec. and *X. lugubris* Lec. Harrisburg, Pa. Reared from dead, soft branches of *Tilia americana.*

Ptilinus ruficornis Say. Hummelstown, Pa. Reared from dead, dry branches of *Acer rubrum* in May. Carroltown, Pa., June 20, specimens submitted from correspondent who stated that they work in the floor of his house, eating the wood as they go.

Bostrichidae

Lichenophanes truncaticollis (Lec.) Harrisburg, Pa. Reared from dead, dry, hard limb of *Fraxinus.*

Brentidae

Brentus anchorago (L.) Found beneath the bark of gumbo limbo (*Simaruba glauca*) at Miami, Fla.—DeLong and Knull.

Platystomidae

Ormiscus saltator Lec. Hummelstown, Pa. Reared from dead, dry, limb of *Acer rubrum.*

Eusphyrus walshi Lec. Identified by H. C. Fall, Harrisburg, Pa. Reared from dead twigs of *Rhus hirta,* also dead twigs of *Robinia pseudacacia* and *Hicoria.*

Allandrus bifasciatus Lec. Harrisburg, Pa. Reared from dead branches of *Tilia americana.* The larvae occur in the outer bark of branches lying on the ground.

Curculionidae

Hormorus undulatus (Uhler). In a previous article, entitled "Notes on Coleoptera in Pennsylvania, New York and Connecticut,"[1] this species is recorded as feeding in the adult stage on the leaves of Solomon's seal. At New Bloomfield, Pa., October 7, 1921, the work on the foliage of Solomon's seal was very evident, although no adults were present. The roots of the plant were then investigated. Here the larvae were found, working externally on the tubers, chewing out large sections in their feeding operations.

The insect probably overwinters in the larval stage, and transforms and emerges in May.

Otidocephalus myrmex (Hbst.) The previous notes[1] on this species were made during the winter months, and under artificial conditions. Since that time observations have been made out of doors through June. The adults appear in numbers at Harrisburg, Pa., about June 2. After this time adults

[1]Entomological News, Vol. xxxii (1921).

may be found in abundance on the branches of the sycamore, and on almost every leaf. In addition to eating the pustules of sycamore blight (*Gnomonia veneta*), they attack the leaf tissue, especially the midrib, where they chew out holes and sections which disfigure the leaves, and leave scars by which diseases may enter. After feeding, the adults oviposit in the stems, which have been newly killed by the blight. *Leiopus alpha* Say[1] mentioned in connection with *O. myrmex* is found in the adult stage at the same time. It confines itself to the dead and dying stems where it feeds exclusively on the blight pustules.

Magdalis pandura Say. Linglestown, Pa., June 14. Lemoyne, Pa. Reared May 3 from walnut—Kirk and Champlain.

Cylindrocopturus binotatus (Lec.) This species is very common at Harrisburg, Pa. It attacks weakened and possibly healthy staghorn sumac (*Rhus hirta*). It seems to prefer trees that have reached maturity and breeds in the sapwood on the main stem and branches.

Apteromechus ferratus (Say). Inglenook, Pa. Breeds in outer corky bark of sassafras, and does considerable damage; in fact, there was evidence enough to show that many trees had been killed. Adults emerge during July. Larvae in outer bark and sapwood.

STUDIES ON THE TAXONOMY AND BIOLOGY OF THE TARSONEMID MITES, TOGETHER WITH A NOTE ON THE TRANSFORMATIONS OF ACARAPIS (TARSONEMUS) WOODI RENNIE. (ACARINA)

BY H. E. EWING,

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In the last few years frequent inquiries have been received from American entomologists in regard to the identity and habits of the Tarsonemid Mites. In response to these it has been found necessary to do some research upon these interesting and economically important acarids. It was thought at one time advisable to work out a synopsis of the American species or possibly even a monograph of them. A more serious reflection, however, showed that such an attempt at this time would be premature and ill-advised. Hence, in response largely to these inquiries I am here presenting certain additions to our knowledge of the Tarsonemid mites.

The Classification of the Tarsonemid Mites.

For many years all the species of this group were included in a single family, the Tarsonemidae. In my classification of the families and higher groups of the Acarina[1] in 1913 two families were recognized. To these should be added the family Disparipedidae of Paoli; and the long recognized and peculiarly degenerate genus *Podapolipus* of Rovelli and Grassi certainly should be accredited with family rank. The most of the genera and these four suggested families are arranged as follows, the more generalized groups being given first:

[1]Ewing, H. E. New Acarina, Part 1 etc. Bul. Am. Mus. Nat. Hist., Vol. xxxii, pp. 93—121, text figs. 1—9, Pls. vii—viii.

THE CLASSIFICATION OF THE FAMILIES AND GENERA OF TARSONEMOIDEA.

A. Both sexes provided with four pairs of funtional legs.

B. Females with elongate bodies; capitulum and first two pairs of legs not covered by any projecting cephalothoracic shield.

C. Posterior legs of female each ending in a pair of claws and caruncle. Species usually ovoviviparous.....*Pediculoididae.*

D. Female with a large capitulum, showing a rostrum and rudimentary palpi; segments of abdomen distinct.

E. Larval stage represented by octopod deutovum stage; gravid female with only the tip of abdominal wall swollen .....*Pediculoides* Tar.-Tpz.

EE. Larval stage normal; most of the dorsal wall of abdomen distended in gravid female.....*Pediculopsis* Reuter.

DD. Female with capitulum reduced to a cephalic papilla, and abdomen indistinctly segmented.....*Pigmephorus* Kram.

CC. Posterior legs of female devoid of claws and caruncle. Species oviparous.....*Tarsonemidae.*

D. Female with pseudostigmatic organs and very slender posterior pair of legs, which in the male are somewhat enlarged .....*Tarsonemus* C. & F.

DD. Female without pseudostigmatic organs and with short, stumpy fourth pair of legs, which in the male are reduced. .....*Acarapis* Hirst.

BB. Females with subdiscoidal bodies; capitulum and first two pairs of legs covered by the projecting cephalothoracic shield.....*Disparipedidae.*

C. Females with posterior legs each composed of five segments and provided with a pair of claws and caruncle.

D. Anterior legs of female each provided with a claw.

E. Segments IV and V of leg IV of female exceedingly slender, cylindrical and subcapillary.....*Imparipes* Berl.

EE. Segments IV and V of leg IV of female short, stout, and V never cylindrical.....*Pygmodispus* Paoli.

DD. Anterior legs of female clawless.....*Diversipes* Berl.

CC. Females with leg IV composed of four segments and without claws and caruncle.

D. Anterior legs of female each provided with a claw .....*Disparipes* Mich.

DD. Anterior legs of female clawless.....*Variatipes* Paoli.

AA. Males hexapod; females in their final stage legless.....*Podapolipidae.*

Contains the singular, degenerate genus.....*Podapolipus* Rov. & Gr.

The best known and probably the most important economically of all the genera of the Tarsonemoidea is the genus *Tarsonemus.* The females in this genus are so nearly alike that no specific characters for their separation have yet been found. The males, however, can be easily distinguished. A key is here given to the males of eleven species:

KEY TO MALES OF TARSONEMUS.

A. Posterior legs with hyaline leaf-like expansions.

B. Each hyaline expansion arising from inner central aspect of large second segment of leg.....*T. spirifex* Mar.

BB. Each hyaline expansion arising from inner distal aspect of large second segment of leg.

C. Second segment of leg IV swollen externally near its base.

D. Large latero-ventral spine of second segment of leg IV situated near the middle of segment.....*T. kirchneri* (Kr.).

DD. Large latero-ventral spine of second segment of leg IV situated almost at distal end of segment.....*T. pallidus* Bks.

CC. Second segment of leg IV not swollen near base.*T. spinipes* Hirst.

AA. Posterior legs without hyaline expansions.

B. Each posterior leg ending in a conspicuous claw.

C. Claw toothed near its base.

D. Body much over one-half as broad as long.*T. floricolus* C. & F.

DD. Body not over one-half as broad as long..*T. brevipes* S. & L.

CC. Claws without tooth.

D. Large second segment of posterior leg with a spur, or tooth-like expansion on inside toward base.....*T. anamas* Tyr.

DD. Large second segment of posterior leg without spur-like expansion on inside.

E. Third segment of posterior leg broader than long.

F. Claw of leg IV about twice as long as distal segment .....*T. chianaspivorus* Ewing.

FF. Claw of leg IV not longer than distal segment .....*T. approximatus* Bks.

EE. Third segment of leg IV twice as long as broad .....*T. waitei* Bks.

BB. Claw of posterior leg reduced to a small tubercle, legs themselves very long.....*T. latus* Banks.

The Mouth-parts in the Tarsonemoidea.

The mouth-parts in the Tarsonemid mites have become consolidated to a great extent and reduced in number of segments and sclerites, and are borne by a clearly differentiated anterior region of the cephalothorax, that should be designated as the capitulum. The degree of reduction in parts and of their consolidation varies in the different species and genera.

In *Tarsonemus pallidus* Banks and in the genus *Tarsonemus* the capitulum is large and conspicuous. In this species the palpi are reduced and fused to a large extent with the capitulum yet segmentation is noted. The chelicerae are represented by a pair of needle-like structures.

In *Pediculoides ventricosus* Newport the mouth-parts are lodged in a large capitulum. The chelicerae are slender and needle-like, or setiform. The palpi are much reduced, and only a single segment is evident, which is free.

In *Pediculopsis graminum* (Reuter) the capitulum of the female is large, the chelicerae are serrate and adapted for piercing but are hardly needle-like. In this species, according to Reuter, the palpi of the female are very minute structures with two free segments. In the male the chelicerae are apparently wanting, and the palpi are represented by a single free segment. Furthermore, the capitulum in *Pediculopsis* is distinctly papilliform.

In the genus *Pigmephorus* and in all the Disparipedidae the capitulum is reduced in size and is papilliform. The mouth-parts in these groups are not necessarily equally reduced. In *Pigmephorus americanus* Banks the palpi, while not entirely free, are seen to be segments. The palpi in the Disparipedidæ show various degrees of degeneration. In *Imparipes hystricinus* Berlese, according to a figure by Paoli, the palpi have four free segments. I have examined an American species of this genus, *I. texanus* (Ckll.). It has rather long, free, laterally-situated palpi, but I can only make out three free segments

Food Plants of Tarsonemus Pallidus Banks.

The cyclamen mite, *Tarsonemus pallidus* Banks, is of late becoming of more economic importance. Moznette[2] (1917) gave three food plants for this species, which were in the rank of relative importance as follows: cyclamen, chrysanthemum and snapdragon. Records are here given for the National Museum specimens: Types from chrysanthemum, Jamaica, N. Y., by Serrine; specimens from snapdragon, Bala, Pa.; from verbena, Bloomsburg, Pa.; from cyclamen, Ithaca, N. Y., by Crosby; from cyclamen, New York City, by H. S. Adams; from cyclamen, Nahant, Mass., by T. Roland; on snapdragon, New Haven, Conn., by S. T. Bradley; on cyclamen, Hartford, Conn., by Q. S. Lowry; on geranium, Whitmarsh, Md., by Sasscer; on cyclamen, Washington, D.C.; on (?), Washington, D. C. (Number on slide is 6751); on heliotrope, Ottawa. Canada, by Fletcher.

The Feeding Habits of Pediculoides Ventricosus Newport.

Pediculoides ventricosus is well known to many entomologists because of its attack on living insects. Dr. Howard has called attention particularly to its attacks on Hymenopterous parasites. This species is the one supposed to have had a disastrous effect upon the Chalcid, *Scutellista cyanea*, at a time when it was hoped that this Hymenopteron would effectively parasitize the black scale. During the past year the writer has had this species under observation, and has noted especially its food habits.

The statement has been made that the adults upon emergence feed upon the body of the female that gave them birth. These statements are undoubtedly true for the adults were repeatedly observed under the binoculars to insert their chelicerae and feed from the juices of the gravid and frequently dead females. Males were observed to feed almost entirely upon the body of their pregnant mother. This type of parasitism might be called autophagous.

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[2]Moznette, G. F. The Cyclamen Mite. Jour Agr. Research, Vol. x, No. 8, pp. 373—390, text figs. 1—6, Pls. li—lii.

Scavenger Habits: That the females of this species (Fig. 1) may live entirely as scavengers was established by the following observation. Late in October, 1921, Mr. Bridwell, of the Bureau of Entomology, gave to the writer a dead Hymenopterous larva inclosed in a small breeding cell that had attached to it engorging females. This larva was kept in its cell and observed daily until Nov. 25. The engorging females soon became replete and gave rise to scores of adult offspring. These second generation individuals attached to the same larva and completely concealed the latter with their distending bodies. On Nov. 25, after many adults had been removed in the meantime, the cell was found to be swarming with the third generation. Thus it was shown that the female of the species may live entirely upon the dead corpses, or in other words as scavengers.

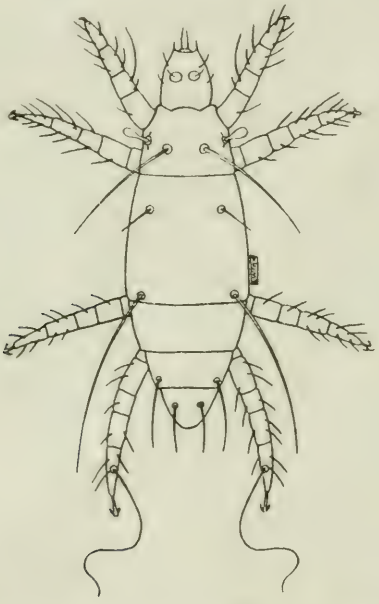

Fig. 1. *Pediculoides ventricosus*, female. (Original).

The Attacks on Man: Experimental observations made to ascertain the nature of attacks on man. Large numbers of the mites were placed; *a.*, on the upper side of the forearm, *b.*, on the side of the body, *c.*, on the tender skin inside of the bend of the elbow. In each of these cases the application of the mites to the skin was followed by a burning sensation. There was but little itching at this time and this burning sensation soon subsided. The appearance of reddened spots, each with a small papule in the centre, was noted the day following application. These spots usually did not develop into wheals but did itch considerably. Within three days the papules were greatly reduced in size and the itching had subsided.

Do the Mites Enter Hair-follicles? On Nov. 5, females were placed on the skin separately and observed continually under the binocular for many minutes. None of these individuals entered the follicles although they were observed to occasionally investigate the mouths of the same. The width of the

female, about 0.12 mm., is greater than that of the unfilled space of most of the hair-follicles. In the case of empty follicles resulting from hair detachment, the mites are small enough to enter. The only way the mites were observed to injure man was by pricking the skin with their chelicerae. The mites never attached permanently or engorged as chiggers do.

Is Itching Due to Crushing of Mites? At 10.30 a.m. one morning many specimens in all stages were crushed on the back of the forearm. Not the least itching or injury developed. It appears, therefore, that the dermatitis that this mite causes, does not come from the crushing of the mites themselves. Just to what it is due cannot be stated at present, but the great delay in the appearance of the papules would indicate that these were not caused by the injection of a toxin.

The Transformations of Acarapis Woodi (Rennie).

Recently the writer has received from Mr. Hirst, of the British Museum, a slide of specimens of *Acarapis woodi* (Rennie), and also has had an opportunity of obtaining some live material through Mr. A. P. Sturtevant, of the Bee Culture Laboratory of the U. S. Bureau of Entomology, which material came originally from Scotland. While it is not at all the intention of the writer to make a special study of this serious parasite of the honey bee, yet it is deemed advisable to compare its different instars with those given for some of our other Tarsonemid species.

Rennie in his interesting and highly important article, "Isle of Wight Disease in Hive Bees—Acarine Disease: The Organism associated with the Disease—Tarsonemus woodi, n. sp.," gives descriptions of the following stages of the Tarsonemid of the honey bee: Ovum, larva, immature female, adult male, adult female. The "so-called" immature female is referred to in one place in Rennie's paper as the female nymph.

In the European material received the present writer does not find any such immature female, but does find a nymphal stage,—a peculiar apodous nymphal stage,— that precedes what Rennie calls the immature female. This nymph is quiescent and never is found outside of the cast larval skin.

Description of Apodous Nymph of Acarapis woodi (Rennie).

One of these apodous nymphs was dissected until it was very largely free from the containing cast larval skin, and another has been found in which the old larval skin has been almost entirely torn away in mounting. A description of the nymphal instar follows:

Apodous Nymph (Fig. 2): When first formed, oval; dimensions and general shape similar to that of engorged and quiescent larva. No legs, no mouth-parts, or any other appendages. Integument well formed, as thick as that of the larva; under low power appearing smooth but under high power seen to be minutely and indistinctly striated. Older nymphs showing, at first distinctly and later plainly, the formation of adult. Adult formed in a manner similar to that of *Pediculoides ventricosus*, the legs and chelicerae appearing first

as minute buds, which later elongate, and finally become segmented. The apodous stage is one of almost complete histolysis followed by the reformation into the adult state. Length of apodous nymph, 0.11 mm.; width, 0.06 mm.

Fig. 2. Apodous nymph of *Acarapis woodi* (Rennie). Ventral view, x600. (Original).

This nymph is homologous with the apodous intrauterine nymph described by Brucker for *Pediculoides ventricosus* and with the extrauterine nymph described by Reuter for *Pediculopsis graminum*. The apodous nymph is very similar physiologically, ontogenetically and morphologically with the pupal stage of most dipterous insects. It represents undoubtedly the nymphal stage of other mites and is in fact a degeneratively and highly specialized nymph.

The Females of Acarapis Woodi (Rennie).

Rennie describes two stages for the female, the immature female and the adult female. I have failed to observe any such stages. What he figures and describes as the immature female the present writer would call the nongravid female, and what he calls the adult female (his Fig. 1) I would call the gravid female, or the ovigerous female,—the latter term having also been applied by Rennie in his formal description. These differences in the female are not fundamental, but are found in all mites, and do not represent differences due to the presence of different instars.

The Eggs of Acarapis woodi (Rennie).

The enormous size of the egg of *A. woodi* greatly impressed the writer in regard to its possible significance. A part of this significance is explained by the finding of a quiescent nymphal stage. Taking no nourishment itself this nymph must have handed on to it an added supply of potential energy. Having to supply this added energy, the larva profits greatly by receiving an added amount at time of hatching, which it gets in the form of a great amount of egg substance, which transformed into a larva produces one already almost as big as it ever gets. Rennie's figures for the dimensions of the egg are: Length, 0.14 mm.; breadth, 0.06 mm. The averages for six eggs measured by the writer are: Length, 0.127 mm.; breadth, 0.067 mm. The figures compare favorably.

The Transformations of Tarsonemid Mites.

In order to help clarify the whole matter of transformations in the Tarsonemidae a comparative study has been made of four species. The transformations of two of these have been so well worked out by two European workers, that in these two cases little will be done except to quote from their results. I have checked up both of these workers by personal studies of the species concerned.

Brucker[3] (1900) has worked out the development of *P. ventricosus* and finds that all stages are passed inside of the uterus of the female, the new and fully formed adult males and females hatching from the egg skin. The first stage of the embryo, according to Brucker, is an octopod stage with segmented appendages. Following the development of the octopod embryo, the segmental appendages become reduced in size, particularly the fourth pair of leg buds; and are curved against the ventral surface of the embryo. Brucker refers to this stage as "l'etat hexapode," notwithstanding it has eight leg appendages. Following the second embryonic stage, the substance of the appendages is absorbed and an apodous stage is reached. This stage is called the apodous pupal stage by Brucker. From this stage the adult emerges.

Reuter finds in *Pediculopsis graminum* Reuter that an octopod embryo first develops and is followed by a hexapod stage in which the fourth pair of leg buds disappear. This is the larva and is the first free-living stage. Later there forms inside of the larval stage a new skin, but with it no appendages develop. This skin Reuter calls the "apoderma" stating that it is the rudimental nymphal skin. The nymphal stage, therefore, is incomplete and is passed inside of the larval skin. From this apodous nymphal instar the adults are formed.

In this country Moznette has worked on the life history of *Tarsonemus pallidus* Banks. He made the important discovery that no free-living nymph exists. He gives the following instars, or stages, for this species: egg, larva, quiescent larva, adults. Speaking of the transformations of this species he states: "No nymphal stage was found in this species and instead of a nymph originating from a larva, as is the case in the life history of most mites, a larva transforms to a quiescent stage, which later gives rise to the adult form." The present writer has received from Moznette a slide of *T. pallidus* in which is found a quiescent larva, within which is a fully formed adult female. I have also observed an abundance of other material of this species and find that the adult mentioned by Moznette is contained, not in the old larva skin, but in an apodous skin inside of the old larval integument. In a specimen received by Moznette a rupture of the old cast larval skin at one end of the body reveals very clearly this latter apodous instar. Further it is noted that the new legs of the first three pairs are formed, not inside of the skins of the larval legs as they are when a legged nymphal stage follows the larval stage, but inside another apodous envelope. This apodous envelope is no other than the skin of an apodous nymphal stage.

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[3]Brucker, E .A.—Monographie de *Pediculoides ventricosus* Newport et Theorie des Pieces buccales des Acariens. Thesis presentées a la Faculté des Sciences des Paris, pp. 355—442, text figs. 1—12, Pls. xviii—xxi.

and it is undoubtedly the same stage as is represented by the apodous nymph of *Pediculoides ventricosus* and *P. graminum*.

When we compare the transformations of these other Tarsonemid mites with those of *T. woodi*, we can interpret those of the latter in a new light. It is observed that the transformations of *T. woodi* are similar to those of the other species here considered, although the morphology of the instars is different, and undoubtedly its life history will be found also quite different. Here is given an annotated chart illustrating by way of comparison the different instars of the four

	EGGS	LARVA	NYMPH	ADULT
Pediculoides ventricosus	Many produced; never laid; about the same size as newly emerged ♀.	Represented by octopod deutovum stage of embryo; no true larva existing.	Represented by apodous intrauterine "pupe", which is really a nymph.	Not degenerate in any way. Facultative predators, scavengers or parasites.
Pediculopsis graminum	Many produced; about two-thirds the size of newly emerged ♀.	Normal, free-living.	Represented by apodous nymph found inside of old larval skin.	Not degenerate; free, sucking juices of plants.
Tarsonemus pallidus	About one-third as large as newly emerged female; is laid.	Normal, free-living.	Represented by apodous nymph formed inside of larval skin.	Normal, not degenerate; sucks juices of plants.
Acarapis woodi	A very large egg, about the size of nongravid female; laid in tracheae of honey bee.	Free-living but degenerate. Two pairs of legs represented by stumps.	Represented by apodous nymph formed inside of old extra-uterine larval skin.	Parasitic (free-living?); female somewhat degenerate.

species considered, the comparable, or homologous instars being placed in vertical columns.

Degeneration and Adaptation in Parasitic Species.

In *Pediculoides ventricosus* Newport there has been apparently no degeneration, but on the contrary, in regard to reproduction at least, there has been great specialization. This specialization has brought about a tremendous increase in the fecundity of the female and is doubtless correlated with the precarious conditions that exist in regard to transferance to new hosts. Of those females that are compelled to leave their mother and search out a new host undoubtedly the vast majority must perish. It is seen that the successful female, having once reached a proper host has an abundance of food, hence she can meet the enormous drain placed upon her because of her great reproductive powers. This reproductive power which brings about the swelling of her body during pregnancy to many times its original size, incapacitates her for locomotion, but only, it is noted, after she has reached her host.

In *Acarapis woodi* degenerative changes have already been noted by Rennie in the shortening of the posterior legs. This species also shows other evidences of degeneration. The second and third pairs of legs of the larva are not only reduced, but exist practically as vestiges. These legs in the free-living species are usually equal to the front pair and are efficiently functional. The sense

organs, called pseudostigmatic organs, which are so conspicuous and characteristic of the females in the Tarsonemidae are lost in the honey bee Tarsonemid, as was noticed by Rennie. In the male there is little evidence of degeneration. The posterior legs are far from being as well developed as they are in many species, yet are about as large relatively as they are in some free-living forms.

All of these degenerative changes observed in *A. woodi* are most easily explained by attributing them to adaptation to a parasitic life. Other structures also indicate a form of adaptation that the writer has found[4] to be general in the parasitic Acarina. This is the development of extraordinarily large setae. The female of *A. woodi,* not only has all the body setae well developed, but two of these located on each of the stumpy, degenerate hind legs are enormous, and in length are about equal to the total length of the body. In regard to the male of *A. woodi* but little specialization is seen in this respect.

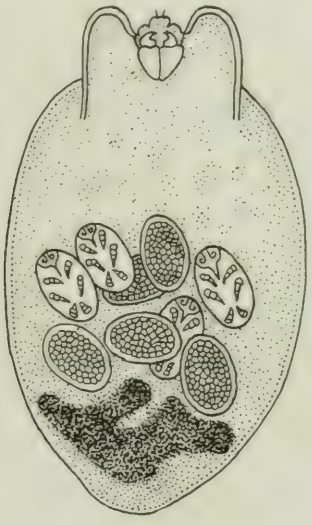

Fig. 3. Ventral view of adult female of *Podapolipus reconditus* R. & G. (After Rovelli and Grassi).

In the parasitic family Disparipedidae both degeneration and adaptation are pronounced. Of the degenerative changes the most pronounced is the shortening of the legs. These may be reduced to mere stumps. It is particularly interesting to note that in this parasitic family the stumpy posterior legs of the female almost invariably have enormous setae as has been observed in the female of *A. woodi.*

The limit of degeneration in the Tarsonemidae, and for that matter for all the Acarina, is found in the genus *Podapolipus* Rovelli and Grassi. In this genus the female (Fig. 3), which is at first hexapod, upon reaching maturity is legless. The male is hexapod. These most degenerate Tarsonemids are found under the elytra of certain Old World beetles.

[4]Ewing, H. E. (1911). The Origin and Significance of Parasitism in the Acarina. Trans. Acad. Sci. St. Louis, Vol. xxi, pp. 11—70, Pls. i—vi (Particular reference, p. 52).

VENATIONAL VARIATION IN RAPHIDIA

BY NATHAN BANKS,

Cambridge, Mass.

In 1891 Albarda published a revision of this family and it has since been the standard work on the group. In this he uses various venational characters in his tables for distinguishing the species. A few years ago (1918) Navas published a monograph of the family, and gave generic names to the sections of Albarda and to some he himself separated from the typical *Raphidia*. Recently in identifying various Raphidians I went over the entire museum collection to see if the venational characters of Albarda and Navas could be utilized to advantage in our species. Having about seventy specimens of ten species of European Raphidia I tested them for these venational characters.

As to the stigma. Several European species are separated by having two veinlets in the stigma, and Navas makes a new genus, *Lesna,* for these forms. In several specimens of *R. notata* one or two wings have a stigma with but one veinlet either forked or simple. In one specimen of *R. major* three wings have a stigma with one forked vein and the other stigma with a simple vein. Both of these species normally have two veinlets in each stigma. *R. xanthostigma* normally has but one veinlet, yet in one wing of one specimen in a series of ten there are two veinlets in the stigma.

In examining several hundred American specimens I find nine specimens in which one or more wings have a stigma with two veinlets; one specimen has it in all four wings; two others have it in three wings; two others in both forewings. The position of these cross veins (as in the European specimens) is not constant. Except for these differences in the stigma, five of these specimens are *R. oblita,* two are *R. occulta*, one *R. adnixa,* and one *R. assimilis;* six are from California, one from Oregon, one from Washington, and one from New Mexico. The five specimens of *R. oblita* are not alike in minor venational characters. It is evident that this character is of no generic value, of no specific value in American specimens, and even in the European must be used with caution.

Albarda and later Navas makes much of the number of cells behind the stigma, called the discoidal cells. These are said to be either three, four or five. Three is most common in the European and four or five in the American species. The extra cells usually reach but part way back to the base of the other cells, in fact I have seen no specimens with five complete cells. In the European specimens before me three seem fairly constant for most of the species, but in *R. notata* a fourth cell of varying size is usually present.

In American specimens the number of cells is much more variable. In a series of eighty *R. oblita* about half have the second discoidal pedicellate in one or both forewings, and of varying size; sometimes extremely minute, in other cases reaching to the base of the other cells. And when it is as far back as the other cells its basal width varies from as wide as that of the other cells to a mere point. In seven specimens there is a fifth cell present in one or both forewings, of varying size; four of these are from British Columbia, three from California.

In fifty-seven specimens of *R. occulta* the extra (second) discoidal cell is present, not often complete, and sometimes very minute.

In thirty-three specimens of *R. adnixa* the extra discoidal is often pedicellate, but frequently complete; in two specimens one wing has a small fifth cell.

In sixteen *R. assimilis* there are none with five complete cells, one or two being pedicellate and sometimes very small, and in one specimen, otherwise agreeing with *assimilis,* there are but three discodidal cells in each fore wing.

In fifteen *R. astuta* four cells are normal, but the second is often pedicellate, and one with a short fifth cell in one wing.

In six specimens of *bicolor* three cells are normal; a fourth is present in varying size in three specimens. Two of the Navasian genera are for American species having four (*Glavia*) and five (*Aguila*) cells, and both distinct from the European *Raphidia* with three cells.

Since this character varies greatly within the various species it certainly is not even of specific, much less generic value.

Navas separates from *Raphidia* typical those forms having one less apical vein into a new genus *Raphidilla*, and Albarda uses a similar character, viz., whether there is a simple third apical vein. In ten specimens of *xanthostigma* this character holds, but in *notata* it varies. When however one tries to apply these characters to American Raphidias the result is nothing less than ridiculous. For of *R. oblita* and *R. occulta* nearly one-half of the specimens are not alike in the two front wings, in fact it is difficult to find a specimen in which the apical venation is even approximately alike in the two fore wings. For example, of the five specimens of *oblita* having two cross-veinlets in a stigma no two are alike in apical venation.

This character is undoubtedly more constant in the European than in the American species, but a character so variable in one part of a genus should not be used to separate another part of that genus into a distinct genus. *Raphidilla* is a synonym of *Raphidia*.

Another genus of Navas, *Subilla*, is based on two species (*schneideri* and *sericea*) with an extra cubital cell. In the two species the extra cell does not occupy the same position. *R. sericea* is only known from the two type specimens, without definite locality, and *R. schneideri* from only few examples from four widely separated countries. Hagen has suggested that *schneideri* may be but a form of *R. cognata*, and it is probable that both these species are but venational variations of some other species. On examining our material I have not found any with the extra cubital cell, but in the allied genus, *Inocellia*, the number of cubital cells varies. Two specimens of *Raphidia* (one Utah, one Idaho) have but two cubital cells in one wing. The character is surely not of generic value.

Still another genus, *Puncha,* Navas creates for *R. ratzeburgi* and *R. insularis* of Europe, on the character of three radial cells in each fore wing. This holds for the few European specimens of these species before me. In *Raphidia* there are three radial cells in the hind wing, and in *Inocellia* in both

wings. None of the American specimens examined have more than two radial cells. In one specimen of *R. ophiopsis* there is but one radial cell in one fore wing, and but two in each hind wing. Variation therefore occurs in this character. The two species included in *Puncha* are very different from each other; one has a simple third apical vein, the other not; one has a long dark stigma, the other a short pale one. It is evident that the two do not form a natural assemblage and that each is more allied to other species.

Another genus, *Alena,* Navas recognizes for two American species, which I had already separated as a section on the number of bullae in the wings. A third species, *australis,* from Lower California also goes in this section. The male genitalia of this section is very different from the other *Raphidia* and it may well be a distinct genus or subgenus.

In examining American Raphidias I have found other variations; not infrequently the end of one of the discoidal cells is lacking, and the position of all cross-veins is variable. Our species usually have the stigma beginning considerably beyond the base of the first discoidal cell, and the dividing veinlet usually arises before the middle of the stigma, but its exact position is not constant in any species. I have four *R. oblita* in which the stigma is long, and the dividing veinlet arises beyond the middle, in two of these the stigma is much darker than usual, otherwise they appear to be *R. oblita.* In *R. bicolor* based on the bicolored stigma the amount of contrast in color is variable. I have seen but two specimens of American Raphidia in which the stigma arises near base of the first discoidal cell; one of these is *oblita,* the other one has peculiar genital plates and appears to be a new species.

In *R. oblita* the stigma is rather pale, but in some specimens it is plainly darker to considerably darker. In *R. occulta* the stigma is more uniformly dark, and usually shorter than in *R. oblita.*

Navas has also divided *Inocellia* into four genera. For two of our species, *inflata* and *longicornis,* he makes a new genus, *Negha,* since both are figured as having two cells in the second cubital series, whilst *hageni* and several European species have but one such cell. This holds for the two specimens of *longicornis* before me, but in *R. inflata* it is variable.

In a series of eleven specimens from Reno, Nevada, three have two cells in the second series, while the other eight have but one cell. Most of them have the stigma long as figured for *inflata,* while three, one with one cell, two with two cells, have it short and over the cross-vein as figured for *hageni,* others have the stigma of intermediate length. Such a character is certainly not of generic importance.

His two other new genera are based on European species of which I have no specimens, but the characters are similar venational variations.

In 1867 Hagen described very briefly five species of Raphidia from Europe using genitalic characters. Most of his specimens were lost in shipping them to Albarda. There are however two still extant. Of *R. corsica* there are two heads and thoraces; these agree closely with *R. insularis* Albarda; of *R. cyprica* there is one good specimen; in Albarda's table it runs to *pontica* Albarda, and agrees with his description and figure.

NEW AND LITTLE KNOWN CANADIAN SYRPHIDAE (DIPTERA)

BY C. HOWARD CURRAN,

Orillia, Ontario.

Syrphus venustus Meigen.

This European species, evidently not heretofore recorded from North America, is rather widely distributed, and I have seen specimens from Mass., Wis., McDiarmid, Ont., and a single specimen captured at Orillia on May 30th, 1921, on bloom of *Osmorrhiza claytoni* in Fitton's woods, late in the afternoon.

In Williston's table the species would trace out to *S. amalopis* O.S., but is readily distinguished. The cheeks and a broad, almost complete, median facial stripe are shining black; eyes short whitish pilose; antennae wholly reddish, arista black. Thorax and scutellum shining aeneous black with whitish or grayish yellow pile; scutellum subtransluscent reddish-orange in some reflections, and with some black pile apically. All the abdominal bands narrowly interrupted and reaching the side margins; the first pair not arcuate, second and third pairs concave in front; all the bands rather narrow. In the specimen before me the first band does not quite reach the margin, or does so indistinctly, a common variation in this species, according to Verrall. The legs are reddish except the bases of the femora and a black ring on the hind tibiae; terminal tarsal joints brown. Verrall reports the species common in England in wooded districts in spring. I can see no differences between the American specimens and European specimens, from France.

Syrphus genualis Will.

This species proved to be moderately common this year. Between April 28th and May 25th I took 14 specimens. The earliest specimens were taken on Cowslip in marshes, later on Wild Plum, Black Cherry and Choke Cherry, and a single specimen on *Osmorrhiza claytoni*. While females predominated both sexes are represented in the series before me. The males have the abdominal bands attenuated laterally.

Syrphus cinctus Meigen.

A European species which proved to be very abundant this spring on the bloom of Wild Plum and Cherry, but not observed elsewhere. My identification has been confirmed by Prof. M. Bezzi, Turin, Italy, who compared specimens with European ones. It traces out to *S. diversipes* in Williston's table, but the thorax and scutellum are wholly pallid grayish white pilose, and the abdomen is somewhat shorter.

Brachyopa perplexa n. sp.

Most closely related to *B. notata* O. S., but arista not as pubescent and epistoma more produced. Larger than *B. media* Will., and with black abdominal markings, the median longitudinal black line practically complete.

Male. Length, 6.5 to 8.5 mm. Face and front pale yellow, thickly covered with white pollen, the cheeks and the frontal triangle, except narrowly next to the eyes, shining; a brownish or ferruginous stripe from the eyes to the oral margin; occiput below shining ferruginous, but above and near the eyes grayish

pubescent. Vertical triangle and a narrow V behind the ocelli on the occiput grayish yellow (sub-golden) pollinose, the ocellar triangle shining brown. Pile of head; a few pale hairs on the cheeks, posterior orbits with long pale pile below, and short black pile arranged in rows, on the upper half. Thorax reddish brown, the sternum more blackish, but covered with grayish pubescence; disc of the dorsum grayish pollinose, leaving four stripes of a shining dark reddish brown, or sometimes blackish; the median stripes very narrowly separated and expanded posteriorly to unite with the sub-median stripes, which are also entire; the opaque area is strictly confined to the disc. A darker, thickly black pilose stripe runs from the postalar callosities to the suture. Dorsum of thorax with short black pile, the pleura with longer white pile. Scutellum brownish yellow with short black pile, but with a few slightly longer bristle-like hairs apically. Abdomen pale yellow to luteous yellow, shining; first segment black, its anterior border yellow; second segment with a narrow median longitudinal black stripe, narrowly separated from the anterior margin, usually plainly joined to the black of the posterior margin, but sometimes only faintly so, (the median spot is ! shaped without the dot below); posterior border narrowly black, sides of segment, except anteriorly, black; third segment similar, darker colored, the longitudinal median stripe and black lateral margins entire; fourth segment similar but usually with the lateral margins more brownish. Hypopygium yellowish red. Pile of abdomen fine, whitish, except on apical half of segments two and three, where it is black. Legs reddish brown; tarsi all brown or blackish, except that the first three joints are yellow apically. Wings slightly yellowish tinged; stigma pale luteous. Squamae clear white, with white pile. Halteres slightly yellowish. In immature specimens taken in early May the abdominal markings are more brownish, and in fully mature specimens the abdomen may be slightly reddish yellow, and is always wholly shining. The thorax may be slightly darker or paler than described.

Female. Averages .5 mm. smaller than the male (the smallest male is 7 mm.); face a little more deeply excavated; front shining ferruginous with a very narrowly interrupted whitish pollinose band below the middle; stripe on cheeks faint or absent; median abdominal stripe boarder, complete on segments 2 to 4 inclusive; transverse bands broader and successively narrower distally; fifth segment yellowish ferruginous with the narrow hind border blackish and the lateral margins ferruginous or brownish. The general color is more ferruginous than in the male.

Holotype, ♂, Orillia, Ont., June 2, 1921; *Allotype,* ♀, Orillia, June 2, 1921, in the Canadian National Collection, Ottawa.

Paratypes, 43 specimens, the majority males, Orillia, May 8th to June 14th, 1921, (Curran) on bloom of Choke Cherry, Black Cherry, Wild Plum, in vicinity of woods, and on bloom of *Osmorrhiza claytoni* in open sub-swampy woods.

B. perplexa differs from *notata* O.S., in the shorter pile on arista, darker thorax and abdominal markings and darker ground color of body, more produced face, as well as in the unclouded wings. From *media* Will it differs in the more reddish color, more produced face, darker abdominal markings; from

flavescens Shann. in the same respects and in the darker thorax; from *gigas* Lovett in its smaller size, less pilose arista, paler color, and in thoracal and abdominal markings. It differs from the remaining species by lacking pollen on the abdomen, except perhaps on the first segment.

Helophilus lunulatus Meigen.

This species was abundant at Cowslip at Orillia during the first week in May this year, (1921) and over 40 specimens were taken, including only three females. My dates range from April 28th to May 22nd. Other bloom on which taken were: Wild Plum, Choke and Black Cherry. It was abundant only on Cowslip.

Brachypalpus apicaudus n. sp.

Male. Length, 13 mm. Head shining black, the face and front obscured by yellowish pubescence, leaving only the cheeks shining. Face in profile retreating to below the middle, thence slightly produced to the tip of the oral margin; first antennal joint piceous, second luteous, third black, its base yellow below; arista yellow, its tip blackish. Eyes very slightly separated; frontal triangle black, with black pile in front; posterior orbits and narrow facial side margins with rather long yellowish pile. Thorax and scutellum aeneous greenish black, moderately short fulvous pilose. Abdomen greenish black, its disc with short, its margins with longer fulvous pile. Apex of fourth segment emarginate in middle, its end reddish yellow. Legs black, tips of femora, bases and tips of the tibiae and the basal three joints of the tarsi yellowish. Legs fulvous pilose except the arcuate hind tibiae which are clothed with short blackish pile. Wings slightly infuscated anteriorly; stigma pallidly yellow.

Holotype, ♂, Cranbrook, B.C., (C. B. D. Garett), in the author's collection.

This species is very closely allied to *B. inarmatus* Hunter, but the thorax is only slightly purplish, the second segment has a metallic bluish reflection and no distinct opaque spot; the legs are more yellowish and the antennae distinctly darker; the hind tibiae terminate in a stout spur.

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POPULAR AND PRACTICAL ENTOMOLOGY

The Control of Insects Liable to be Imported in Railway Cars

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The desire to check the increase or to prevent the establishment of insect pests in British Columbia has always been one of the main objects of economic entomologists and horticultural field inspectors in pursuit of their official duties. This object has been especially emphasized as regards fruit-infesting insects for the reason that horticulture and the cultivation of fruit has been considered, in the past, the "first arm" of the agricultural industries of the Province. The Codling Moth is particularly classed as an undesirable insect pest of apples and pears, liable of importation into any given fruit-growing section, and it is with this insect and its control that this article has special reference. As a matter of general information, the Codling Moth, until the present day, has not become generally distributed throughout the fruit-growing areas of the Province, neither is it as yet regarded as an insect which requires attention as a regular established orchard pest. There are between 30,000 and 40,000 acres of fruit in the Province of British Columbia, three-quarters of which acreage is located in that part of the Province known as the "dry Interior" where irrigation is commonly practised, and of this 20,000 acres close upon 850 acres were under quarantine at the close of the year 1921; but it is probable that not much more than 300 acres were actually infested with the Codling Moth. Where this insect occurs the control operations are under Government surveillance, the burden of control not having as yet been thrown upon the shoulders of individual growers.

This is an interesting point for the general information of entomologists, but in as much as the Codling Moth does occur in the province to a somewhat limited extent the problem of control may be and has been considered under two distinct phases.

(1) The control of the insect within the Province.

(2) The closing of the avenues of importation.

The first phase detailing the stringent regulations which govern an area under quarantine by Government, has been dealt with on other occasions. It will not be necessary to mention this information again at this time except to state that the control operations are strictly based upon eradicative procedures and that total eradication of the Codling Moth has been successful in eight outbreaks out of twenty that have occurred until the present time. The following table indicates the degree of success that has attended the operations on the present infested areas as it affects the fruit growing areas of the Interior.

TABLE 1. Showing the number of larvae of the Codling Moth taken in British Columbia in the fruit-growing areas of the Okanagan and Similkameen Valleys and points on the main line of the Canadian Pacific Railway east from North Bend.

Year	Acreage under quarantine	Number of larvae and pupae taken
1915	335	10,000
1916	330	3,500
1917	330	600
1918	375	394
1919	500	373
1920	645	174
1921	850 approx.	785

The second phase of the problem is as important as the first and in as much as certain lines of study in this connection have been conducted, which have now reached a certain stage of finality, this article has been written to illustrate not only the stage of development of the fruit industry of British Columbia, the centres of outbreak of the Codling Moth, but also the means and methods of introduction of this pest with suggestions for preventing its further importation.

According to the Market Reports and the Agricultural Records of the Department of Agriculture but particularly from a brief prepared under the direction of the British Columbia Fruit Growers Association before a sitting of a Federal Tariff Commission in September, 1920, the following statistical data are noted.

In 1891 the fruit industry of British Columbia boasted approximately 450,000 fruit bearing trees; in 1901, 649,091; in 1911, 2,677,486; in 1913, 2,978,993; while in 1920, 1,165,369 apple and pear trees alone were producing fruit in the Okanagan and Similkameen Valleys and at points on the main line of the Canadian Pacific Railway east of North Bend. The production of apples far outdistances, in numbers, the quantity of other tree fruits grown, representing 77 per cent of all trees planted. The yield from these trees is recorded as follows:

1910..... 210,000 boxes of apples
1911..... 250,000
1912..... 430,000
1913..... 477,000
1914..... 685,000
1915..... 787,750
1916.....1,289,980
1917.....1,502,921
1918.....1,343,450
1919.....2,524,132
1920.....1,500,000
1921.....3,150,000 (estimate to date—October)

From these records it may be quite readily seen that the heavy plantings and the greatest expansion in the tree-fruit industry occurred in British Columbia during 1909, 1910 and 1911, with a sudden rise in the apple output in 1916 and again during the past few years when the trees became more mature. Today between $20,000,000 and $25,000,000 of capital is invested in the British Columbia apple industry, out of a total of about $35,000,000 for all fruits raised in the Province. This valuation approximates that of Nova Scotia, doubles that of Quebec and is less than half that of Ontario.

These figures, while known to horticulturists, are presented in this article to indicate to the minds of entomologists the stage of development of the fruit industry and the relation of that industry to the numbers and varieties of orchard pests present. The Codling Moth, without question, ranks first as the most serious insect threatening the apple industry of the Province. Oregon (Wilson) estimates the annual loss to the apple industry of that State due to the Coding Moth as 25 per cent of the total crop. Washington (Melander) claims an annual loss of $200,000 on the average yield of 1,500 cars. Wenatchee district (Darlington, 1918) estimated a $1,000,000 loss in fresh fruit prices on an 8,350 carload output, but as between 7 per cent and 8 per cent of infested fruit was used in by-product factories an actual loss of $800,000 was sustained. Ontario (Caesar) loses over $2,000,000 a year from this insect and these records, while appearing high, do not take into consideration the cost of orchard spraying operations. The probable effect of the Codling Moth on the apple industry may thus be easily computed.

The valleys suitable for growing fruit in the Province of British Columbia run north and south, connecting with the fruit valleys of the State of Washington and Idaho. Up to the present time there is not, neither has there been, any direct connecting chain of planted orchards; a distance of twenty-five miles and more has separated the fruit-growing sections of the two countries. In other words there has been no infestation of the Codling Moth from infested territory to the south of British Columbia by flight of the moths. The fact remains, however, that the Codling Moth has been taken in British Columbia at various times, in varying degrees of intensity, during the past fifteen years. These centres of infestation are referred to as outbreaks and these outbreaks have been entirely caused by the actual importation of larvae, pupae and moths during the fruit shipping season or through settlers' effects during winter. There is little doubt that similar conditions occur in all fruit raising districts in North America and that the Codling Moth is continually being imported into enterprising fruit sections without the knowledge of the majority of the inhabitants. The conditions in British Columbia, with respect to the youth of the industry, presents an example which is worth recording. Let us examine, therefore, the outbreaks as they have occurred in the Province until the present time, and note how they have been caused in the light of the best information on the means of introduction.

TABLE 2. Showing the number of outbreaks of the Codling Moth in British Columbia and the probable means of introduction.

Year discovered	Locality found infested	Probable cause and remarks
1905	Victoria	Californian pears
	Kamloops	Ontario apples.
	Kaslo	Ontario apples.
1912	Armstrong	Oregon nursery stock or infested railway cars
	Rutland	Ontario fruit in settlers' effects.
1913	Kelowna	Infested railway cars.
1915	Kelowna	Infested railway cars, second outbreak.
	Okanagan Landing	Infested railway cars.
	Westbank	Apple boxes from Kelowna.
	Eburne	U. S. infested fruit.
1916	Walhachin	Infested railway cars.
1917	Vernon	Fruit from Okanagan Landing.
1918	Okanagan Landing	Infested railway cars, second outbreak.
1919	North Bend	Infested railway cars.

1920	Swan Lake	Infested railway cars.
	Kelowna	Reoccurrence from old centre.
	New Westminster	U. S. infested fruit.
	Walhachin	Infested railway cars, second outbreak.
1921	Kamloops	Infested railway cars, second outbreak.
	Okanagan Landing	Infested railway cars, third outbreak.

It may be seen from this table that the Codling Moth has been imported into British Columbia through the following channels:

1. Infested railway cars, 55 per cent.
2. Infested imported fruit, 30 per cent.

10 per cent of the outbreaks have been caused by the local movement of fruit and fruit boxes from infested territory and 5 per cent has been the reoccurrence of an outbreak that was believed to have been eradicated.

British Columbia may roughly be divided into three fruit-growing areas, viz.: the Coast, including Vancouver Island and the Lower Fraser Valley; the Interior, including the irrigated fruit areas of the Okanagan and Similkameen Valleys and points on the main line of the Canadian Pacific Railway east of North Bend; the Kootenays or Eastern British Columbia. In the examining of the table given above we find that from the standpoint of the Interior fruit-growing areas, where the great majority of the apples are grown and where the Codling Moth if it became a general orchard pest would be far more serious than at the Coast, that sixteen outbreaks have occurred, 69 per cent of which have been directly attributed to infested railway cars, to which may be added 19 per cent caused by the removal of fruit or boxes from an area infested through the medium of railway cars and 12 per cent caused through the importation of infested fruits either in the box or in settlers' effects from Ontario or the United States.

It should be quite clear, therefore, that the infested railway car is by far the most important medium through which the Codling Moth may be introduced into new fruit districts. Our evidence on this point is quite clear, in as much as, larvae, pupae and adult moths have been taken in empty refrigerator railway cars rolled into the Okanagan Valley for the reception of local grown fruit. This point may be extended somewhat for the benefit of those who are not conversant with conditions.

Apples and pears are loaded into refrigerator cars in the fruit growing areas in the States of California, Oregon, Idaho, Washington and Montana. Many of these cars find their way for sale on the Canadian Prairies, and as the Codling Moth occurs in varying degrees of intensity in each of the States mentioned there is no doubt that the fruit is infested with Codling Moth larvae when it is loaded into the cars. Some of this American fruit also finds its way to Coast points in British Columbia and the records of the Provincial Fruit Inspection Department show that much of the fruit is infested with Codling Moth larvae. The fruit in the States to the south of British Columbia matures somewhat earlier than the local grown product, thus when the time arrives to move the British Columbia crop and requests are made for empty refrigerator cars or "reefers," many of these cars are found on the Prairies and in Vancouver ready for reloading. Hence they are rolled to any point requiring them for use particularly in the sale of the British Columbia product in the American markets. We are not concerned in this article as to where the local product finds its sale but we are

concerned with the empty railway car, which formerly held fruit in the same season, destined for loading at British Columbia points for export trade.

These cars have been examined too often to leave any doubt that they are the chief means of introducing the Codling Moth into British Columbia.

The following table shows the record of the number of cars inspected at one point in the Province and the degree of infestation.

TABLE 3. Showing the number of United States railway cars inspected at Okanagan Landing, B. C., with the number infested with live Codling Moth material.

Year	Number of foreign cars inspected	Number of cars infested with live Codling Moth	Number of live larvae, pupae and adults found
1918	58	10	21
1919	378	47	203
1920	181	14	47
1921	125 (to Sept. 7)	26	89

This does not take into consideration the number of cars found to contain empty pupal cases from which the adult moths have emerged. The above table proves definitely that healthy Codling Moth material is being imported into the Province year by year and that the larvae unquestionably have emerged from fruit shipped in the same year and probably within one month of the date of discovery. A very long and extended table might be built up to show the actual car numbers, the railway system to which the cars belong and to some extent the most recent point of loading of United States fruit and the number of cars found infested in some way or another, whether as live larvae or pupae or as empty pupal cases. There is no virtue in presenting such a table. We can content ourselves with the statement that fully 50 per cent of the United States refrigerator cars received in British Columbia are or have been infested with the season's larvae of the Codling Moth. As many as 150 empty pupal cases have been taken out of single cars at the point of inspection and 50 and 60 empty cases are commonly found. Of the 50 per cent of cars found infested an average of 25 empty pupal cases have been taken in each car in a single season.

Infested fruit in transit from the United States allows time for the Codling Moth larvae to mature, to vacate the fruit and to find some suitable crack or crevice in the apple box or in the car lining to form its cocoon. Cars unloaded of fruit on the Prairies thus contain larvae and these cars when required at some fruit loading station in British Columbia are rolled empty, often partly iced and frequently uncleaned. It has been the custom to clean these cars out in British Columbia just previous to loading. The original sources of infestation have undoubtedly been caused by this action. As this car movement usually occurs in mid-summer and until autumn there is every opportunity for larvae spun up in the car linings to mature, pupate and emerge. Temperatures inside these cars have been taken and they frequently register 80 and 90 degrees Fahrenheit. As frequently happens cars are held up on sidings for two or three weeks at a time, especially at the time pending the movement of the crop and tie-ups often occur with "empties" during the rush of the season to make way for loaded trains. When this happens and with ventilators open the adult moths have no difficulty in making their escape into the nearest orchard. The great majority of the larvae, their pupae or pupal cases are found in the crevices of the wood linings of the cars four feet from the floor to the ceiling. Nail holes, broken boards and loose beading are commonly chosen and it is not an unusual sight in a car in poor repair to see a dozen or more Codling Moth larval cocoons clustered on

the insulation paper lining beneath a loosened board. The importance of this method of introduction of a dangerous pest has been recognized in British Columbia for many years. Steps have been taken to lessen the danger but despite the willingness of railway operators to cooperate in every way possible, mistakes occur, with the result that outbreaks have taken place. The closest type of inspection system is unsatisfactory. The human element in the rush of the season causes the failure and mistakes are costly.

It has been evident during the past two years that other steps must be taken to bolster up the inspection system to better eliminate chances of failure. With this in mind treating cars at some point outside of the fruit-growing sections with gas, chemicals or heat has been considered. Icing cars to reduce the temperatures and so to check larval or pupal development has been carried in mind but after full consideration of the problem from all angles, including that of the railwayman, the application of heat is considered the most satisfactory.

It was thought probable that if steam were injected into the cars for a certain length of time, no damage would take place to the insulation, the Codling Moth larvae would be killed and the procedure would be rapid enough not to cause delay in the movement of freight. Consequently on May 1, 1920, a single car was treated with steam to determine the temperatures that could be reached in a certain length of time and its effect on insect life. Through the courtesy of the Canadian Pacific Railway Company the refrigerator car No. 282546, Bohn System, Dressed Meat Service, with a capacity of 1906 cubic feet with three ply insulated walls, was treated with steam supplied from a locomotive. A three inch rubber hose was inserted through the drainage vent at one end, under the pressure of 60 degrees.

Previous to the application of steam the inside temperature of the car registered 54 degrees Fahrenheit, with a relative humidity of 75 degrees. Outside shade temperature registered 63 degrees Fahrenheit. Specially constructed clinical self-registering thermometers, capable of registering 300 degrees Fahrenheit were tied to laths, which were let down on cords through one of the ventilators on the roof of the car, furthest away from the intake of steam. At intervals of 5, 10 and 15 minutes the steam was shut off on the engine for a sufficient length of time to remove the ventilator plug and one of the thermometers. The temperature records were as follows:

In 5 minutes the temperature registered 148 Fahrenheit.
In 10 minutes the temperature registered 182 Fahrenheit.
In 15 minutes the temperature registered 195 Fahrenheit.

A sack half filled with rice meal placed on the floor of the car in the centre with a self-registering thermometer in the centre of the sack registered 100 degrees Fahrenheit in 15 minutes.

The following insects were used in the experiment:

1. Codling Moth larvae overwintering in larval cocoons in folds of corrugated cardboard.
2. Cutworm larvae (*Noctua c-nigrum*) ½ to ¾ inches in length, buried in slightly moistened sand, two inches deep in six inch tin boxes without lids, and full grown larvae in sleeved mica chimneys.

3. Adults of *Epicnaptera americana,* moths and pupae of the same rolled in cotton batting and absorbent cotton in three inch square cardboard boxes with lids.
4. Eggs of the Oyster Shell Scale on apple twigs.

Two sets of this material were arranged, one set being suspended from the ceiling of the car in the centre and the other set on the floor in the centre of the car. Control or untreated material was also held for comparison.

It was not possible in this experiment to remove any of the material from the car under the 15 minute exposure but in this length of time all the forms of insect life were destroyed. No injury resulted to the car and in all respects the experiment was a pronounced success.

Further information was desirable, however, on the effect of steam on the insulation of cars, the cost of treatment, the time required to destroy Codling Moth material in cars in poor repair or partly iced. Consequently in August, 1921, four cars were treated with locomotive steam in the same way as in the previous year with the exception that a flattened iron pipe was inserted into the car beneath the closed door on one side.

The following table illustrates the points noted:

TABLE 4. Showing temperatures obtained in standard refrigerator cars following the application of steam and notes on the condition of the cars.

Car number	Steam applied in minutes	Temperature registered	Remarks
59533	10 minutes	164 Fahr.	Car in good shape; no defects, varnished. Insulation not affected.
96229	15 minutes	160 Fahr.	Car in fair condition; capacity 60,000; one bad split but the insulation not affected.
95004	20 minutes	160 Fahr.	Car in good shape; no defects, varnished, capacity 70,000; insulation not affected.
58441	20 minutes	175 Fahr.	Car in fair shape; one bad crack, paper lining showing, moisture present on paper lining.

In supplementing these notes it is observed that moisture condensed on the ceilings of the cars and drops continued to fall for at least half an hour after opening up. The walls while they were wet and warm on opening up dried rapidly and no ill effects were observed. In each of the cars mentioned above Codling Moth larvae and pupae were placed in paper cartons attached to the ceiling and laid on the floor. The following table indicates the results obtained:

TABLE 5. Showing the results of treatment with steam on Codling Moth larvae and pupae.

Car number	Number of larvae and pupae	Number left alive after treatment	Remarks on state of the car
58533	10	2 pupae	No ice in the bunkers.
96229	10	0	One foot of ice in bunkers.
95004	10	0	Two feet of ice in bunkers.
58441	10	0	No ice in the bunkers.

The results of these experiments indicate that Codling Moth larvae and pupae may readily be destroyed by steam heat in the ordinary refrigerator car in 15 minutes with the final registration of 160 Fahrenheit with or without ice in the bunkers. Through the kindness of the Canadian Pacific Railway officials the wood lining of the cars was removed at one or two places in each car and the insulation paper examined. The weakest spot in the car was chosen for

examination in each case and in every instance no damage resulted to the insulation, except in one instance where a badly broken board allowed moisture to condense on the paper lining, but apparently without lasting deleterious effects. In other words the experiments point clearly to the fact that no damage to the insulation will take place if the car is in good repair. As to the cost of treatment this point cannot be decided upon unless the exact number of cars requiring treatment in a season is known and until proper equipment is installed to take care of the proceedings as a regular operation.

In closing this article I would like to draw attention to the statistical data given as regards areas under quarantine, acreage in fruit and the captures of larvae and pupae in railway cars. Without the sincere cooperation of the Provincial Horticultural officials, notably Mr. W. T. Hunter, District Horticulturist for the Interior sections, and his assistant, Mr. H. H. Evans, these tables could not have been compiled or certified correct. Full acknowledgement is hereby given to the earnest support given by these officials not only in the preparation of this paper but also for the cooperative spirit always in evidence between entomologists and horticulturists in the study of the Coding Moth in the Province.

CONIFEROUS HOSTS OF THE IPIDAE OF THE PACIFIC COAST AND ROCKY MOUNTAIN REGIONS

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During the past few years our knowledge of the breeding habits of many of the bark-beetles has been greatly increased. Some of these species are very destructive, especially to the principal commercial trees such as sugar pine (*Pinus lambertiana*), western yellow pine (*Pinus ponderosa*), and Jeffrey pine (*Pinus jeffreyi*), Western White Pine (*Pinus monticola*) and Douglas Fir (*Pseudotsuga taxifolia*). The most injurious Ipid beetles infesting each tree species will be found in the host list marked with an asterisk.

Since many of these beetle species inhabit only one or a few species of trees, an accurate knowledge of the hosts is important to the forester engaged in the control of the insect depredations which become, or are liable to become epidemic. For instance, if the destructive insect will attack and become epidemic in only one coniferous species, the control work is much simplified, since it need deal only with the particular species of tree. If the insect attacks and breeds in several species of trees on the same area the control work is obviously much more complicated, as all species of trees infested by this beetle must be treated.

There has been considerable doubt expressed whether some species of beetles, as for instance *Dendroctonus monticolae* Hopk., attacking the lodgepole (*Pinus contorta* Loudon) will, when the progeny emerges, attack another species of tree such as a yellow pine, which it is also known to infest. If this assumption could be verified, epidemics in any one species could be exterminated or practically controlled without considering other species of trees infested with the same destructive beetle. It seems highly probable though that certain species of Ipids under endemic conditions will confine their attacks to one species of tree,

showing a preference to specific food; but that under epidemic conditions they will attack any of the tree species they are known to breed in. We do know, however, that certain species breed in only one particular species of tree or one group of tree species. Certain genera of these bark borers are even confined to certain generic groups of trees. Thus, in California, the genus *Dendroctonus* (with one exception) and the genus *Ips* are found wholly in the genus *Pinus*. The genus *Pseudohylesinus* is found (with one exception) in the fir group of trees, and *Phlocosinus* in the cypress and redwood group. There are notable exceptions, for example, a *Phlocosinus* is found in pine; one species in Canada and another in India.

The loose way in which entomologists refer to hosts under local names should be discontinued. Unless the exact locality is known such words as bull pine, tamarack, jack pine, spruce may mean any of a number of species. Spruce, for instance, is not found in California except in the extreme northwestern part; tamarack in California is a popular name for *Pinus contorta*, while in Washington and the interior of British Columbia it means *Larix occidentalis* and on the coast of British Columbia, *Abies amabilis;* spruce may mean *Pseudotsuga taxifolia* or it may mean a true *Picea*, while Jack Pine is either *Pinus contorta* or *Pinus divaricata*. The use of technical names is definite. Unfortunately many of our entomologists are not good botanists and wrong identification of trees, shrubs and herbaceous plants is very common. Therefore, in quoting hosts from literature one should be very conservative and should consider carefully the source from which the information is derived. The host trees given below are actual hosts, verified by Doctor J. M. Swaine or the author, and the beetles were personally collected from the trees, except for a few well authenticated records.

Coniferous Host Trees and Their Ipid Fauna

host—*Pinus ponderosa* Laws.

1. *Dendroctonus brevicomis* Lec.*
2. *Dendroctonus monticolae* Hopk.*
3. *Ips confusus* Lec.*
4. *Ips oregoni* Eichh.*
5. *Ips emarginatus* Lec.*
6. *Ips latidens* Lec.
7. *Ips integer* Mann.
8. *Dendroctonus valens* Lec.
9. *Gnathotrichus retusus* Lec.
10. *Pityogenes carinulatus* Lec.
11. *Pityogenes fossifrons* Lec.
12. *Conophthorus ponderosae* Hopk.
13. *Orthotomicus ornatus* Swaine.
14. *Hylurgops subcostulatus* Mann.
15. *Hylurgops rugipennis* Mann.
16. *Carphoborus simplex* Lec.
17. *Pityophthorus confinus* Lec.
18. *Pityophthorus confertus* Swaine.
19. *Pityophthorus serratus* Swaine.
20. *Xyloborus xylographus* Say.
21. *Trypodendron ponderosae* Swaine.

host—*Pinus lambertiana* Dougl.

1. *Dendroctonus monticolae* Hopk.*
2. *Ips emarginatus* Lec.*
3. *Ips confusus* Lec.
4. *Ips latidens* Lec.
5. *Dendroctonus valens* Lec.
6. *Conophthorus lambertianae* Hopk.
7. *Carphoborus simplex* Lec.
8. *Gnathotrichus retusus* Lec.
9. *Hylurgops subcostulatus* Mann.
10. *Hylurgops rugipennis* Mann.
11. *Pityophthorus confinus* Lec.
12. *Pityophthorus tuberculatus* Eichh.
13. *Pityophthorus confertus* Swaine.

*Species known to kill living trees.

HOST—*Pinus jeffreyi* "Oreg. Com."

1. *Dendroctonus jeffreyi* Hopk.*
2. *Ips emarginatus* Lec.*
3. *Ips oregoni* Eichh.*
4. *Ips radiatae* Hopk.
5. *Ips latidens* Lec.
6. *Dendroctonus valens* Lec.
7. *Gnathotrichus retusus* Lec.
8. *Pityogenes carinulatus* Lec.
9. *Hylurgops subcostulatus* Mann.
10. *Hylastes macer* Lec.
11. *Orthotomicus ornatus* Swaine.
12. *Pityophthorus confinus* Lec.
13. *Pityophthorus confertus* Swaine.

HOST—*Pinus contorta* Loudon

1. *Dendroctonus monticolae* Hopk.
2. *Ips vancouveri* Swaine.
3. *Ips oregoni* Eichh.
4. *Ips plastographus* Lec.
5. *Ips radiatae* Hopk.
6. *Ips interpunctus* Eichh.
7. *Ips latidens* Lec.
8. *Pityogenes carinulatus* Lec.
9. *Pityogenes knechteli* Swaine.
10. *Pityogenes fossifrons* Lec.
11. *Hylurgops pinifex* Fitch.
12. *Gnathotrichus retusus* Lec.
13. *Orthotomicus ornatus* Swaine.
14. *Dendroctonus valens* Lec.
15. *Dendroctonus murrayanae* Hopk.
16. *Pseudohylesinus sericeus* Mann.
17. *Pityophthorus confertus* Swaine.
18. *Pityophthorus atratulus* Lec.
19. *Hylurgops lecontei* Swaine.
20. *Hylurgops rugipennis* Mann.
21. *Hylurgops subcostulatus* Mann.
22. *Scierus annectans* Lec.

HOST—*Pinus sabiniana* Dougl.

1. *Ips latidens* Lec.*

HOST—*Pinus monticola* Dougl.

1. *Dendroctonus monticolae* Hopk.*
2. *Ips vancouveri* Swaine.
3. *Ips latidens* Lec.
4. *Ips integer* Eichh.
5. *Ips confusus* Lec.
6. *Pityophthorus confertus* Swaine.
7. *Eccoptogaster monticolae* Swaine.
8. *Hylurgops rugipennis* Swaine.
9. *Hylurgops porosus* Lec.
10. *Hylastes nigrinus* Mann.
11. *Dendroctonus valens* Lec.
12. *Pityogenes fossifrons* Lec.
13. *Gnathotrichus sulcatus* Lec.

HOST—*Pinus radiata* Don.

1. *Ips radiatae* Hopk.
2. *Ips plastographus* Lec.
3. *Dendroctonus valens* Lec.
4. *Hylastes nigrinus* Mann.
5. *Hylurgops rugipennis* Mann.
6. *Pseudohylesinus sericeus* Mann.
7. *Carphoborus radiatae* Swaine.
8. *Pityophthorus carmeli* Swaine.
9. *Pityophthorus atratulus* Lec.
10. *Conophthorus radiatae* Hopk

HOST—*Pinus balfouriana* Murr.

1. *Dendroctonus monticolae* Hopk.
2. *Ips vancouveri* Swaine.
3. *Dendroctonus valens* Lec.
4. *Hylurgops rugipennis* Mann.
5. *Hylurgops pinifex* Fitch.

HOST—*Pinus monophylla* Torr. & Fremont.

1. *Ips confusus* Lec.

HOST—*Pinus torreyana* Torr.

1. *Pityophthorus torreyanae* Swaine.

HOST—*Abies concolor* Parry

1. *Pseudohylesinus granulatus* Lec.*
2. *Eccoptogaster ventralis* Lec.*
3. *Eccoptogaster praeceps* Lec.*
4. *Platypus wilsoni* Swaine.
5. *Gnathotrichus sulcatus* Lec.

HOST—*Abies magnifica* Murr.

1. *Pseudohylesinus granulatus* Lec.*
2. *Leperisinus imperialis* Eich.
3. *Eccoptogaster ventralis* Lec.*
4. *Platypus wilsoni* Swaine.
5. *Gnathotrichus sulcatus* Lec.
6. *Pityokteines elegans* Swaine.

HOST—*Abies grandis* Lindl.

1. *Eccoptogaster ventralis* Lec.
2. *Pseudohylesinus granulatus* Lec.
3. *Pseudohylesinus grandis* Swaine.
4. *Conophthorus monticolae* Hopk.
5. *Gnathotrichus sulcatus* Lec.
6. *Cryphalus subconcentralis* Hopk.

HOST—*Abies lasiocarpa* Hook.

1. *Dryocoetes confusus* Swaine.*
2. *Ips borealis* Swaine.
3. *Cryphalus canadensis* Chamb.
4. *Trypodendron ponderosae* Swaine.
5. *Pityokteines jasperi* Swaine.*
6. *Orthotomicus lasiocarpi* Swaine.
7. *Pityophthorus pseudotsugae* Swaine.
8. *Platypus wilsoni* Swaine

HOST—*Pseudotsuga taxifolia* Britt.

1. *Dendroctonus pseudotsugae* Hopk.*
2. *Pseudohylesinus nebulosus* Lec.*
3. *Pseudohylesinus grandis* Swaine.
4. *Eccoptogaster ventralis* Lec.
5. *Eccoptogaster unispinosus* Lec.
6. *Eccoptogaster tsugae* Swaine.
7. *Eccoptogaster monticolae* Swaine.
8. *Platypus wilsoni* Swaine.
9. *Trypodendron cavifrons* Mannh.
10. *Pityokteines minutus* Swaine.
11. *Pityophthorus confinus* Lec.
12. *Pityophthorus pseudotsugae* Swaine*
13. *Gnathotrichus sulcatus* Lec.
14. *Gnathotrichus retusus* Lec.
15. *Hylastes nigrinus* Mann.
16. *Hylastes ruber* Swaine.
17. *Dryocoetes pseudotsugae* Swaine.
18. *Cryphalus subconcentralis* Hopk.
19. *Trypodendron ponderosa* Swaine.

HOST—*Pseudotsuga macrocarpa* Torr.

1. *Dendroctonus pseudotsugae* Hopk.

HOST—*Picea engelmanni* Engelm.

1. *Dendroctonus borealis* Hopk.*
2. *Ips engelmanni* Hopk.
3. *Ips tridens* Mann.
4. *Ips dubius* Swaine.
5. *Ips yohoensis* Swaine.
6. *Dryocoetes septentrionis* Mann.
7. *Dryocoetes affaber* Mann.
8. *Orthotomicus ricinus* Lec.
9. *Scierus annectans* Lec.
10. *Trypodendron ponderosae* Swaine.
11. *Pityophthorus intextus* Swaine.

HOST—*Picea sitchensis* Bong.

1. *Dendroctonus obesus* Mann *
2. *Ips vancouveri* Swaine.
3. *Ips concinnus* Mann.
4. *Ips interruptus* Eichh.
5. *Cryptturgus borealis* Swaine.
6. *Dolurgus pumilus* Mann.
7. *Dryocoetes septentrionis* Mann.
8. *Dryocoetes affaber* Mann.
9. *Pseudohylesinus sitchensis* Swaine.
10. *Platypus wilsoni* Swaine.

HOST—*Picea canadensis* Mill.

1. *Ips interruptus* Eichh.
2. *Carphoborus carri* Swaine.
3. *Pityophthorus intextus* Swaine.

HOST—*Libocedrus decurrens* Torr.

1. *Phlocosinus punctatus* Lec.*
2. *Phlocosinus vandykei* Swaine.*
3. *Phlocosinus hoppingi* Swaine.

HOST—*Juniperus scopulorum* Sarg.

1. *Phlocosinus hoppingi* Swaine.

HOST—*Juniperus occidentalis* Hook.

1. *Phlocosinus juniperi* Swaine.*
2. *Phlocosinus rugosus* Swaine.

HOST—*Sequoia sempervirens* Endl.

1. *Phlocosinus sequoiae* Hopk.
2. *Phlocosinus cupressi* Hopk.

HOST—*Sequoia gigantea* Dec.

1. *Phlocosinus punctatus* Lec.

HOST—*Cupressus macrocarpa* Hartw.

1. *Phlocosinus cupressi* Hopk.

HOST—*Cupressus sargentii* Jepson.

1. *Phlocosinus cupressi* Hopk.
2. *Phlocosinus minutus* Swaine.

HOST—*Thuja plicata* Don.

1. *Phlocosinus punctatus* Lec.
2. *Phlocosinus sequoiae* Hopk.

HOST—*Tsuga mertensiana* Bong.

1. *Eccoptogaster tsugae* Swaine.
2. *Gnathotrichus retusus* Lec.

HOST—*Tsuga heterophylla Raf.*

1. *Pseudohylesinus tsugae* Swaine.
2. *Gnathotrichus sulcatus* Lec.
3. *Platypus wilsoni* Swaine.

HOST—*Larix occidentalis* Nutt.

1. *Dendroctonus pseudotsugae* Swaine.
2. *Orthotomicus vicinus* Lec.
3. *Pityophthorus intextus* Swaine.

IPIDAE OF PACIFIC COAST AND ROCKY MOUNTAIN REGION

Carphoborus Eich.
- *carri* Sw. b.
- *radiatae* Sw. a.
- *simplex* Lec. a.

Conophthorus Hopk.
- *lambertianae* Hopk. a.
- *monticolae* Hopk. a, b.
- *ponderosae* Hopk. a.
- *radiatae* Hopk. a.

Cryphalus Fr.
- *canadensis* Chamb. b.
- *subconcentralis* Hopk. b.

Crypturgus Erichs.
- *borealis* Sw. b.

Dendroctonus Erichs.
- *borealis* Hopk. b.
- *brevicomis* Lec. a. b.
- *jeffreyi* Hopk. a.
- *monticolae* Hopk. a. b.
- *murrayanae* Hopk. b.
- *obesus* Mann. b.
- *pseudotsugae* Hopk. a. b.
- *valens* Lec. a. b.

a. Records from California.
b. Records from British Columbia.
a.b. Records from California and British Columbia.

Dolurgus Eichh.
pumilus Mannh. b.

Dryocoetes Eichh.
affaber Mannh. b.
confusus Sw. b.
pseudotsugae Sw. a. b.
septentrionus Mannh. b.

Eccoptogaster Herbst.
monticolae Sw. b.
praeceps Lec. a.
tsugae Sw. b.
unispinosus Lec. a. b.
ventralis Lec. a. b.

Gnathotrichus Eich.
retusus Lec. a. b.
sulcatus Lec. a. b.

Hylurgops Lec.
lecontei Sw. b.
pinifex Fitch a.
sorosus Lec. b.
rugipennis Mannh. a. b.
subcostulatus Mannh. a. b.

Hylastes Er.
macer Lec. a. b.
nigrinus Mannh. a. b.
ruber Sw. b.

Ips De Geer.
borealis Sw. b.
concinnus Mannh. b.
confusus Lec. a.
dubius Sw. b.
emarginatus Lec. a. b.
engelmanni Sw. b.
interpunctus Eich. a.
interruptus Eich. b.
integer Eich. a. b.
latidens Lec. a. b.
oregoni Eich. a. b.
plastographus Lec. a.
radiatae Hopk. a. b.
tridens Mannh. b.
vancouveri Sw. a. b.
yohoensis Sw. b.

Leperisinus Reitter.
imperialis Eich. a.

Orthotomicus Ferr.
lasiocarpi Sw. b.
ornatus Sw. a. b.
vicinus Lec. b.

Platypus Herbst.
wilsoni Sw. a. b.

Phlocosinus Chap.
cupressi Hopk. a.
hoppingi Sw. a. b.
juniperi Sw. a.
minutus Sw. a.
punctatus Lec. a. b.
rugosus Sw. a.
sequoiae Hopk. a. b.
vandykei Sw. a.

Pityophthorus Eich.
atratulus Lec. a. b.
carmeli Sw. a.
confinis Lec. a.
confertus Sw. a. b.
intextus Sw. b.
pseudotsugae Sw. a. b.
serratus Sw. a.
torreyanae Sw. a.
tuberculatus Eich. a.

Pityokteines Fuchs.
elegans Sw. a. b.
jasperi Sw. b.
minutus Sw. a.

Pityogenes Bedel.
carinulatus Lec. a. b.
fossifrons Lec. a. b.
knechteli Sw. b.

Pseudohylesinus Sw.
grandis Sw. b.
granulatus Lec. a. b.
nebulosus Lec. a. b.
sericeus Mannh. a. b.
sitchensis Sw. b.
tsugae Sw. b.

Scierus Lec.
annectans Lec. b.

Trypodendron Steph.
ponderosae Sw. b.
cavifrons Mannh. a. b.

Xyleborus Eich.
xylographus Say a.

Such species as *Pinus jeffreyi, radiata, balfouriana, sabiniana, torreyana* and others found in California and not in British Columbia are often hosts of species not found further north and in British Columbia the spruces breed species not found as far south as California, depending largely on the distribution of their hosts. Of the ninety-two species listed thirty-five are common to British Columbia and California and probably to Oregon and Washington; twenty-four are found in California and not as yet in British Columbia, and thirty-three are found in British Columbia and not in California. The distribution of species listed only from British Columbia and California depends largely upon the distribution of the hosts upon which they breed. Some of the species such as *Dendroctonus brevicomis* (*barberi*), *Dendroctonus monticolae* (*ponderosae*) extend south through the Rockies to Colorado, New Mexico and Arizona; this is probably also true of several *Ips* and *Pityophthorus*. Very little is known of the smaller Ipids inhabiting the central Rockies south of Alberta and British Columbia.

In regard to the deciduous trees of this region, *Anisandrus pyri* Peck has been found in apple at Vancouver and in Oregon and *Leperisinus californicus* Sw. in olive in California. The latter species is a native of the chapparal, apparently breeding in some of the numerous species of *Ceanothus*.

Alniphagus aspericollis Lec. breeds in *Alnus oregona* Nutt. and *Trypodendron retusus* Lec. in *Populus tremuloides* Mich. both in British Columbia and California, and they are probably found wherever the western alders and poplars exist. *Betula occidentalis* Hook. is the host of *Dryocoetes betulae* Hopk. in British Columbia. Several other species have been reported from the western coast but have not been verified by the author.

Dr. Hopkins* reports *Xyleborus arbuti* Hopk. from *Arbutus menziesii* Parsh. from Calif., *Cryphalus pubescens* Hopk. from *Abies grandis* Lindl. Port Williams, Wash., and *Cryphalus approximatus* Hopk. from *Abies grandis* Lindl. Several other Ipid species not in the list are known from this region but the hosts have not yet been determined.

NOTES ON THE LEPIDOPTERA OF ALBERTA

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The months of June, July and part of August, 1921, were spent by me in Nordegg, Alta., collecting insects for the Canadian National Collection. This locality has of late years become more or less famous through the entomological activities of Messrs. K. Bowman of Edmonton and F. C. Whitehouse of Red Deer, this latter gentleman having published an interesting account of the region and its dragonfly fauna in the Canadian Entomologist, 1918, L. pp. 1, 95.

In spite of rather adverse weather conditions and a remarkable lack of warm, clear days a very interesting collection of Lepidoptera was obtained; most of the species have already been recorded in Mr. Bowman's Check List of Alberta Lepidoptera but several new records were secured; these are embodied

*Class. of the Cryphalinae.

in the present paper, together with notes on a few other obscure species which may help to clear up their specific status.

Eurymus gigantea Stkr.—The species has always been considerable of a puzzle to entomologists. Strecker described it as a form of *pelidne* and Staudinger under the name *pelidnoides* placed it as a form of *palaeno*; the material on which both these names was based came from the West Coast of Hudson Bay, north of Ft. Churchill. After an examination of Strecker's types it was referred by me (1917, B. & McD., Contributions, III, 121, 68) to *christina* as a yellow variety. Wolley-Dod in his notes on Albertan Lepidoptera (Can. Ent. XXXIII, 19; l. c. XL, 187) places it doubtfully under the name *occidentalis*, mentioning that he could only separate it from *christina* by color but hazarding the opinion that two species were involved. I first met with this yellow species at Nordegg about the middle of July and soon found that it was practically entirely restricted to the muskegs. *Christina* was commonly found on the dry slopes and could be taken throughout July around the flowers growing in such locations; to obtain *gigantea*, however, it was necessary to visit the muskegs. It was further noticed that the females of *gigantea* were yellow whereas those of *christina* belonged to the whitish form. This gave rise to strong suspicions in my mind that I was dealing with species rather than with forms and I resolved if possible to secure data regarding the food-plants. It was comparatively easy to discover that the females of *gigantea* were depositing ova on the leaves of the several varieties of dwarf willows so prevalent on the hillocks of the muskeg. Several freshly deposited eggs were secured. These, I might mention, hatched in about ten days, the young larvae resting on the mid-rib of the leaf and eating small portions of the upper epidermis; they showed little signs of growth and on leaving Nordegg I was forced to relinquish them; the larvae evidently hibernates in a very early stage.

With *christina* I had more difficulty but was finally successful in surprising one of the large white females depositing an egg (which I secured) on a small species of lupine with greenish-white flower. The above differences in larval food-plant and habits constitute a valid reason to my mind for considering *gigantea* and *christina* to be distinct species. Willow as a food-plant is most unusual in the *Eurymus* group and the only other record of a similar food-plant which I have been able to find is given by Edwards (But. N. Am. III, Suppl. Notes) who mentions that Bruce saw females of *scudderi* in Colorado depositing ova on willow and that he himself reared larvae of this species to the third moult on weeping-willow. As *scudderi* is an inhabitant of the high peat moors of the Coloradan Rockies, a close relationship between *gigantea* and *scudderi* is not improbable. As regards the points of distinction between *gigantea* and *christina* I must agree with Wolley-Dod that the color is practically the only means of separation; I have seen no *gigantea* males with even the faintest suspicion of orange color whilst on the other hand *christina*, even in advanced *astraea* forms, shows slight orange shades beyond the cell and along the veins. Generally speaking the discal mark on under side of secondaries is single in *christina* and more or less double in *gigantea* but this character is not entirely constant. The color of the females is probably also not constant, although in the Nordegg region and similar regions of Alberta it is a valuable aid to identification.

Oeneis taygete Bdv.—To my surprise I captured on the Coliseum Mt. (6500 ft.) a series of this species flying over the dry grassy slopes along with *brucei* Edw. Apart from the genitalia it is best distinguished from *brucei* by the white veins on the underside of secondaries and the presence of a black median line on underside of primaries. *Taygete* has not previously been recorded from Alberta although its occurrence in the Yukon Territory and extreme northern British Columbia has long been known.

Heodes florus Edw.—This species apparently bears the same relationship to *helloides* Reak. that *Eurymus gigantea* does to *christina* Edw., i. e., it is a typical inhabitant of the bogs and muskegs whereas *helloides* flies on dry hillsides and on the open prairie.

At Nordegg the species was decidedly rare although widespread, and during the last of July and the early part of August isolated individuals could usually be taken by a careful search of the few flowering plants present at this time in the muskeg.

The name *florus* was proposed by W. H. Edwards (Can. Ent. XV, 210) for a species collected by Capt. Gamble Geddes in 1883 while on a trip from Edmonton south to the Crow's Nest Pass, in which the present line of the C. P. R. railroad from Edmonton to MacLeod was roughly followed; in the original description the locality is given as "Red Deer River" but Capt. Geddes later (Can. Ent. XV, 223) changes this to "Garnett's Ranch." The Geddes collection, now incorporated in the Canadian National Collection, contains six males of this species, four labelled "Calgary, July 4, '83" and the other two "Crow's Nest Pass, Aug. 10, '83." It is probable therefore that the type specimens were taken at various points along the above-mentioned route, as Geddes was neither very precise nor accurate in his data regarding localities. In any case, as the Nordegg specimens agree exactly with Geddes' material, it seems safe to assume that *florus* inhabits the bogs and swamp regions of the Rocky Mt. foothills.

In our latest Check List *florus* has been listed as a variety of *helloides* but in view of its habitus I believe that it should rather be associated with *dorcas* Kby. which inhabits similar regions and the larva of which feeds on cinquefoil (*Dasiphora fruticosa*) and potentilla (Newcomb, Can. Ent. XLI, 221). In fact it would be a matter of small surprise to me if my Nordegg specimens should prove to be more nearly typical of *dorcas* than the Michigan specimens recorded by Newcomb under this name.

Dorcas was described by Kirby (1837, Fauna Bor. Am. IV, 299) from a female specimen collected in "Lat. 54", which I might note is only slightly north of Edmonton, and the type specimen is probably lost. The figure given (Pl. IV, fig. 1) shows distinct orange shading in the postmedian area of primaries and the anal angle of secondaries contains *two* orange lunules. One of my Nordegg ♀'s matches this figure quite closely, although the average ♀ from this region appears to possess more orange on primaries and *three* orange lunules on secondaries. On the other hand in a Michigan series before me from Dr. Newcomb the females in general show decidedly less orange than in Kirby's figure, the anal lunules being either reduced to a single one or lacking entirely. Judging from the series before me, however, the amount of orange shading on

primaries and the number of orange lunules on secondaries in both sexes is variable and of little value as a specific character. In other respects I can see no tangible differences between the Nordegg and the Michigan series.

Helloides does not apparently fly at Nordegg but Mr. K. Bowman records it in his Alberta List from Edmonton, Red Deer, etc., and there is a single ♂ in the Dod Collection from the Calgary region. The Canadian National Collection contains a very typical series from various Manitoba prairie localities, the female being of the large coppery form and the marginal lunules in both sexes well developed. *Dorcas* is also present in certain Manitoba bogs; it was recorded by E. F. Heath (Can. Ent. XXXI, 95) as a variety of *helloides* and Mr. N. Criddle takes it each year in a bog near Aweme, Man., where potentilla grows. These Aweme specimens cannot be separated from the Nordegg ones.

While there is no doubt that we have two forms in the Canadian Prairie Provinces, primarily distinguished by their markedly distinct habitus and on this account doubtless entitled to specific rank, it seems hardly probable that a third good species exists in this region. In view therefore of the essentially similar nature of the faunal regions in which the type specimens of *dorcas* and *florus* were captured, the most logical proceeding would seem to be to sink *florus* as a synonym of *dorcas*.

Apantesis turbans Christ.—The larvae of this species were quite common in June on dry slopes and meadows. They were very constant in maculation and the following brief description is offered.

Head shiny black, with posterior portion of cheeks orange. Body jet black with short black spiculate hairs from tubercles in dorsal and subdorsal area and red hairs laterally and as a fringe over the head. Pale broken dorsal line consisting of two spots on each segment, a small circular one on the posterior edge of the segment and a linear dash on the anterior edge, closely approximate to the circular one, which has much the size, shape and color of a Tachinid egg. A few longer black hairs at posterior end of body.

The dotted dorsal line is quite characteristic and separates the larva at once from that of *virguncula*. I have grave doubts as to whether the species can be considered to be a form of *queuseli* Payk.; a comparison of the larvae of the two forms should decide this point; whether or not the name *turbans* is correctly applied is also a point for systematists having access to Siberian material to settle.

Mr. A. Gibson has given good figures of the species in the Canadian Entomologist, 1903, Vol. XXXV, Plate V; he also figures a specimen which had been identified by Dr. Dyar as *obliterata* Stretch; this specimen is very obviously a form of *turbans* but I am not certain that it actually represents *obliterata* as figured by Stretch in Journal New York Entom. Society, 1906, Plate VI, fig. 14. In this latter figure the veins of the fore wings, notably vein 2, are much more continuously outlined in white than in any Albertan specimens of *turbans* in the long series I have before me, approaching in this respect *virguncula*. A few of the specimens captured or bred at Nordegg show reddish tinges on secondaries and one specimen in the National Collection from Aweme, Man., is very decidedly red.

Euxoa westermanni Staud.—Mr. K. Bowman and myself took six or

seven specimens at light about the middle of July which seem to belong to this species. They agree excellently with Smith's characterization in his Agrotid revision and match fairly closely Aurivillius' figure in Greenland's Insect-fauna. Hampson's figure under this name (Cat. Lep. Phal. IV, Pl. 69, fig. 20) is evidently based on a misidentification and should be referred to *Epipsilia wockei* Moesch.

Apharetra dentata Grt.—A single ♂ taken by Mr. Bowman and a ♀ captured by myself at light during the third week of July I am inclined to refer to the above name. These two specimens differ from *pyralis* Sm. (of which part of the type series from Calgary and a very fine ♂ from High River, Alta., are before me) in the much paler color of the primaries, which are distinctly light-gray shaded with black rather than black suffused with gray (*pyralis*). In a note-book of Mr. Wolley-Dod's, containing unpublished comments on the British Museum types, I find under *dentata* the following, "Looks exactly like a pale *pyralis*. Figure (Hampson. Cat. Lep. Phal. Brit. Mus. IV, Pl. LXXVIII, fig. 21) much too contrasting." This remark characterizes the Nordegg specimens excellently and leads me to the above reference; I am not convinced that *dentata* and *pyralis* represent two specific units but for the present they may stand separated.

Acronycta canadensis Sm.—The name *canadensis* was tentatively applied in Smith and Dyar's monograph of the genus (p. 57) to two specimens from Murray Bay, Que., and Calgary, Alta. In his notes on Alberta Lepidoptera, Mr. F. H. Wolley-Dod (Can. Ent. 1904, p. 353; op. cit. 1911, p. 148) offers some remarks on this species, stating that the Calgary ♀ is marked type in the U. S. National Museum and that he has a ♀ in his collection from the same locality marked by Smith as agreeing with type; this ♀ is now in the Canadian National Collection. At Nordegg I captured three specimens at light which agree well with the above mentioned ♀; I also was successful in securing several larvae sitting in their characteristic manner on the upper side of aspen leaves and from these bred two ♂s and one ♀. These larvae were covered with long yellowish hairs with five dorsal black hair-pencils from tubercle I on joints 5, 7, 8, 9 and 12; they appeared to me to be in no wise different from larvae of *populi* Riley with which I was familiar from numerous specimens found on poplar in Decatur, Ill. I also obtained similar larvae and a resulting series of bred specimens at Norway Point, Lake of Bays, Ont., in 1920. Compared with my Alberta specimens eastern specimens (Chicago, Ill.; New Brighton, Pa.; Ottawa, Ont.; Lake of Bays, Ont.) are decidedly more suffused with white scaling in the central areas of primaries, the Nordegg specimens being rather evenly blue-gray in coloration of primaries, approaching in this respect the *felina* group. A tendency in this direction is, however, distinctly noticeable in certain of my bred Lake of Bays material, notably the ♀'s, and a pair before me from Larder Lake, Ont. (Nipigon region), is quite as suffused as the Albertan series. I can see no essential difference in the maculation of the various series; the length of the black basal dash, so much emphasized by both Smith and Hampson, is obviously of no specific value and depends on the amount of white hairs or scales in that particular region in the individual specimens. I have long been of the opinion that in this particular group we have more names than species on our lists and this view was shared by Mr. Wolley-Dod (Can. Ent. 1918, p. 49) in his criticism

of the 1917 Check List. I have recently received a photograph of the type ♀ of *lepusculina* Gn. through the kindness of Mr. F. LeCerf of the Paris museum, and in the light of the above remarks believe that both *populi* Riley and *chionochroa* Hamp. will fall to *lepusculina* Gn.; *canadensis* Sm. may be retained for the darker western race and *cinderella* Sm. with *transversata* Sm. as a probable synonym will apply to the Colorado form, concerning which at the present time I have not sufficient fresh material before me to form an opinion. I might note that in Manitoba (Winnipeg, Aweme) we meet with an extremely white form which is liable to be confused with *cretata* Sm.; this may be worthy of a name but for the present I include it under *cinderella* Sm.

Autographa diasema Bdv.—In a recent paper on Labrador Lepidoptera (Can. Ent. 1921, p. 85) I associated *diversigna* Ottol. with this species as a western race of same. I believe now, in the light of specimens collected at Nordegg, that this was a mistake and that we are dealing with good species. I took a number of fresh specimens of *diversigna* at light during July and further a single specimen in beautiful condition on July 13th, which at the time looked different, due to the duller color of the secondaries. On returning to Ottawa I found that this Nordegg specimen agreed excellently with the Labrador specimen mentioned above and also with a specimen of *diasema* I had discovered in the Wolley-Dod collection labelled "Lule, Lappmark;" Mr. Bowman, at my request, looked through his series of *diversigna* and sent me for examination two specimens from Nordegg which also proved to be *diasema*. Apart from the duller-colored secondaries *diasema* is most readily separated from *diversigna* by the fact that the metathoracic tufting lacks the bright-brown tinges characteristic of *diversigna;* the gray areas of the primaries are also more decidedly gray and show less of the purplish suffusion of *diversigna* and the area enclosed by the U mark has no reddish filling as is often the case in the latter species. These differences are slight but in view of the fact that both forms occur in the same territory and can be separated without much difficulty on the above characters, I thing that Dr. Ottolengui's contention that two species are involved should be accepted.

Cerura occidentalis gigans var. nov.

Several specimens of a puzzling *Cerura* species were captured at light; from a female a number of eggs were obtained and the resulting larvae brought successfully through to pupation; a few of the pupae emerged unexpectedly the same fall and the adults were found later in a totally battered condition; one pupa emerged early in 1922, but the remainder appear to be holding over for a second year. A brief description of the various larval stages was made and from a comparison with existing descriptions, the larva appears to approach very closely to that of *occidentalis* Lint. On comparing the Nordegg adults with the material in the National Collection it was found that they were similar to a long series taken by Mr. Wolley-Dod in the Calgary region and referred to by him in his notes on Alberta Lepidoptera (Can. Ent. 1913, p. 299) under the name *Harpyia scolopendrina* Bdv. They can however be at once distinguished from this species by the smokier nature of the white ground color and by the fact that the row of black dots on the basal side of the median dark band is distinctly made up of five dots and not of four. From typical *occidentalis* they differ in their much larger size and the noticeably darker character of the median and subapical black bands; as

however they agree with *occidentalis* in other particulars of maculation and apparently also in the early stages it would appear best to regard our Alberta specimens as a western race of *occidentalis* for which I propose the above varietal name. The Holotype male in the Canadian National Collection is labelled "Head of Pine Creek, Calgary, Alta. (May 29, 1910) (F. H. Wolley-Dod)," the Allotype ♀ is from the same locality (29th April, 1915) and there is also a series of Paratypes from this locality before me; a single specimen from Kaslo, B. C., is in our National Collection, labelled *scolopendrina*. I append the larval notes drawn up from the Nordegg specimens.

Egg. Black; similar in shape to other members of the genus.

Larva, Stage I. Head red; body black, tinged with reddish laterally and turning later to deep red-brown. Prothorax with usual side protuberances. Dorsally an oval yellow patch extending over metathorax and abdominal segment I; a similar but narrower yellow patch dorsally over abdominal segments IV-VI. Filaments blackish-red crossed by two pale bands.

Stage II. Head and body deep red-black. The yellow patches much as in preceding stage; the one on metathorax and 1st abdominal almost square with the anterior corners generally jutting forward partly across the mesothorax and not continued so far back across abdominal segment I. Prolegs and ventral surface dull greenish gray. Tubercles small, black, with short black hairs. Anal plate black. Filaments banded twice with yellow and with pale reddish tips.

Stage III. The yellow thoracic patch has become divided into two lateral triangles of yellow due to the meeting centro-dorsally of the apices of dark triangles. Laterad of these yellow triangles the body-color is greenish, tinged with brown, this color extending on to the 2nd abdominal segment on a line continuing the lateral edge of the yellow triangle. The abdominal yellow triangle has either completely disappeared or is reduced to a diffuse yellowish shading cut by a geminate dark centro-dorsal line. On abdominal segments III-VIII the dark ground color extends below spiracle, on VI-VIII being slightly shaded with paler marking. Legs, prolegs and venter greenish, on VII-last segments with brown central shading. Filaments brown, cut twice by yellow.

Later in the stage the green lateral thoracic coloring merges with the yellow leaving the characteristic dorsal brown triangle bordered with yellow with posterior apex at rear of mesothorax, and a further triangular dorsal dark patch with apex touching that of the thoracic triangle and with its lateral edges extending backward and downward to below spiracle on abdominal segment III, thence running below spiracles of segments IV and V and bent upward to a point on anterior margin of VIII just behind tubercle II, then slightly downward again to rear segment.

Stage IV. Larva of the typical *Cerura* form. Head purple-brown shaded with paler laterally and frontally. Body with the dorsal portion purple-brown, roughly divided into 3 areas; a triangular thoracic section, a saddle-shaped abdominal region and a small diamond shaped anal portion, all connected and bordered laterally by a yellow line. The triangular thoracic portion has its apex at the dorsal rear of the mesothorax at which point there are two slight protuberances; the lateral edges of the saddle meet almost at a point immediately behind these tubercles, then slope rapidly and obliquely to a point on rear of 2nd abdom-

inal segment in a line with the spiracle; on the 3rd abdominal segment a rectangular downward projection is formed including the spiracle and on the 4th a similar rectangular projection extends the dark color to the base of the prolegs with generally the lowest point between the first two pairs of prolegs. From here the edges slope rapidly upward to the subdorsal area of the 8th segment, being at this point about 1-1½ mm. apart, then broaden considerably across the 9th, narrowing again on 10th, thus forming the above mentioned anal diamond patch. At the deepest point of the saddle there is considerably diffuse ochreous shading forming a lateral patch on 3rd and 6th abdominal segments and in late stages there is a marked tendency for the whole saddle area to become paler. From the rear of the metathoracic legs a purple band, bordered on upper side by yellow, extends ventrally backward across 1st and 2nd abdominal segments and there is an oblique band of same color on prolegs which on 7th-10th abdominal segments forms a broad band of dark color, often coalescing with a centroventral dark line found on these same legs. Lateral area of body green with sparse yellow sprinkling and orange spiracles.

THE DAILY MAXIMUM FEEDING PERIOD OF MELANOPLUS FEMUR-RUBRUM. *

BY W. H. LARRIMER AND A. L. FORD,

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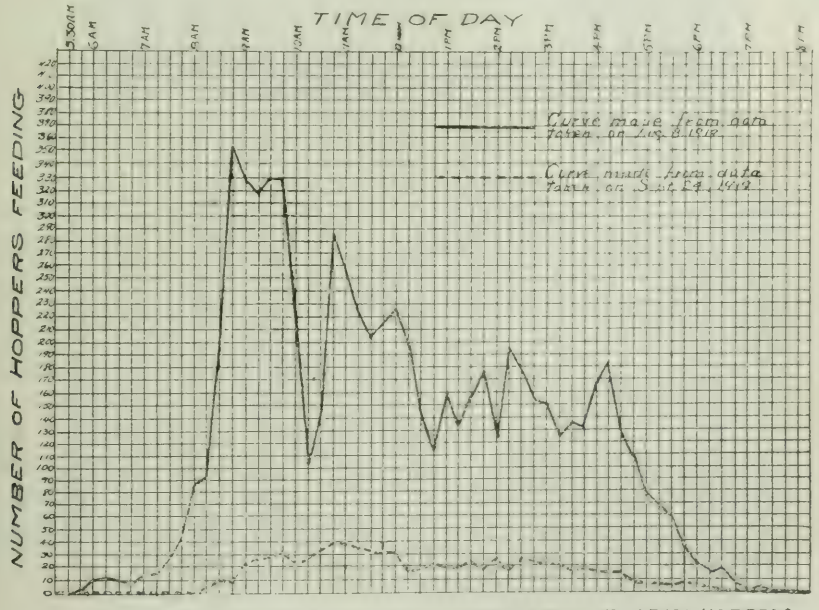
While making a study of the feeding habits of *Melanoplus femur-rubrum* at Lafayette, Indiana, during the late summer of 1919, it was possible to obtain some data on the time of day the maximum feeding period of this species occurred.



CURVE SHOWING THE DAILY MAXIMUM FEEDING PERIOD OF GRASSHOPPERS

* Published by permission of the Secretary of Agriculture.

The observations by which these data were obtained were made in the following manner: Card-board discs one foot in diameter were placed in an infested field and equal amounts of similarly mixed bran mash put in the center of each. By the use of a pair of field glasses counts were made of all grasshoppers either feeding or within the six inch radius of the baits (Fig. 1) at 15 minute intervals from daylight until dark. Fresh mash was supplied when needed to avoid possible error due to drying. Experiments were run on Aug. 8, 1919, with six cards and again on Sept. 25 with 12 cards. The accompanying curve shows the number of hoppers feeding at each 15 minute interval during these two days. (The time used in these curves is that prescribed by the Daylight Saving Law of 1918 and 1919.)

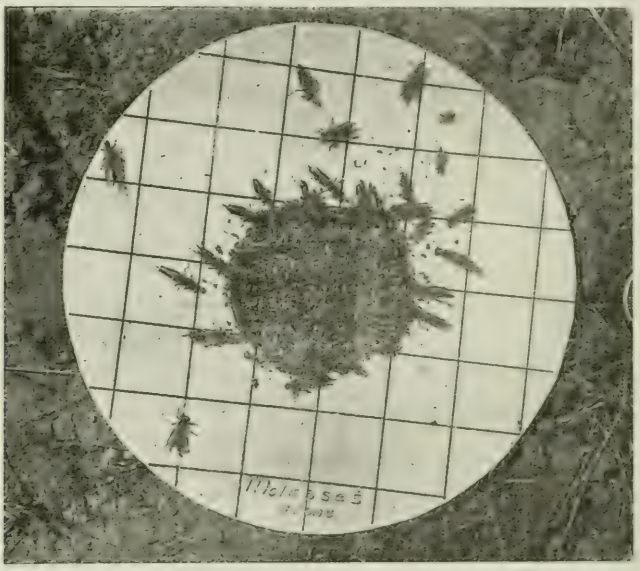


Fig. 1.—Cardboard disk in position in the field showing bran bait and grasshoppers attracted to it.

Although the grasshoppers were much more abundant on Aug. 8 than on Sept. 24, there was but little difference in their maximum feeding periods. The curve for Aug. 8 shows a marked fall at 10.15 A. M. and again at 12.45 P. M., undoubtedly due to the changing of baits at 10.00 A. M. and 12.30 P. M. On Aug. 8 the greater part of the feeding occurred between 8.30 A. M. and 12.30 P. M., while on Sept. 24, 9 A. M. and 12.15 P. M. marked the limits of this period. On Aug. 8 there was considerable feeding activity in the afternoon until 4.15 when it dropped suddenly until 7.15, at which time the last hopper was observed to have fed. On Sept. 24 feeding activities gradually decreased after 2.30 P. M., the last being recorded at 6.30 P. M. These observations indicate that the maximum feeding period for grasshoppers under these conditions occurs between 8.30 A. M. and 12.30 P. M. (new time). Therefore, to obtain the best results from the use of poison bran mash it should be applied in the morning not later than 8.30 A. M. thus having the mash in the field in a moist condition during the maximum feeding period.

While performing these experiments a careful study was made on the habits of grasshoppers with reference to the time of day. It was found that early in the morning the hoppers were inactive and roosting on the tops of grasses and weeds; they would not jump when disturbed, it being possible to pick them off with the fingers. At about 7.30 A. M. some activity was noticed, the hoppers jumping or flying in all directions when disturbed. This activity increased until 10.00 A. M. when it was perhaps at its maximum. They remained in this active condition until about 4 P. M. when they again began to show signs of sluggishness. Between 5.30 and 6.00 P. M. many were found going to roost and by 6.30 P. M. practically all were settled for the night.

SOME CANADIAN BEES

BY T. D. A. COCKERELL,

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In the Canadian Entomologist 1916, pp. 270, 271, 312, Mr. F. W. L. Sladen published three supposed new species of Canadian bees, two of them types of new genera. No detailed descriptions were given and the determination of these forms has remained somewhat problematical. I am indebted to Dr. J. H. McDunnough for the loan of the specimens, in order that some further particulars may be given.

Stelis (*Stelidium*) *trypetina* (Robertson).

S. ontariana Sladen was queried by its describer as *trypetinum,* and I am unable to separate it from Robertson's species. There is only one difficulty, concerning the apical ventral segment of the female. Robertson, in his original description, says there is a subapical carina. In *ontariana* this is not easily observed, but with a side light it can be seen that there is a slight longitudinal ridge or elevation. But Robertson, in a later paper (Trans. Am. Ent. Soc., XXIX, 170) says there is a *transverse* preapical carina. This I cannot see at all, and suspect a slip of the pen.[1] Everything else agrees perfectly.

Many years ago, I described a bee from Sante Fe, New Mexico, as *Stelis lateralis* var. *permaculata.* In 1901 I separated it as a distinct species, finding that it had nothing to do with *lateralis.* It is, in fact, a *Stelidium*, very close to *trypetinum* (*ontariana*). The type (male), compared with the male type of *ontariana*, is found to be smaller (length 4.5 mm.), with the basal nervure slightly basad of the nervulus, more so on one side than the other (exactly meeting it in *ontariana*), wings much clearer (strongly suffused with brown in *ontariana*), white lateral face-marks well developed, especially the lower part (nearly obsolete in *ontariana*). It seems quite possible that these differences are only subspecific, in which case *trypetinum* or *trypetina* will rank as a subspecies of the earlier published *permaculata.*

Chelostoma (*Autochelostoma*) *canadense* (Sladen)

♂, Length about 8 mm.; black, the flagellum (except basally) obscurely

[1]The broad shining apical margin is rather abruptly separated from the dull basal part of the segment and it is possible that this effect might suggest a carina, which is certainly not present.

brownish beneath, tarsi reddened apically; tegulae dark brown; wings dilute fuliginous, with dark stigma and nervures; hair of head and thorax long and white. Process on second ventral segment of abdomen very large, broad, triangular; sixth dorsal segment broadly truncate, with no median tooth, but with small dentiform lateral angles; seventh segment long and acutely pointed. The sixth has faint indications of a subapical fovea, which is bare and shining. The whole insect is glistening, the head and thorax with very fine close punctures. This is a *Chelostoma*, apparently nearest to *C. foveolatum* (Morawitz) of Europe. In the American fauna it comes closest to *C. californicum* (Cresson), but is easily separated by the characters of the abdomen. Superficially, it has much the appearance of *C. nigricorne* (Nyl)[2] and *C. florisomne* (L).

The venation resembles that of *nigricorne*, except that the marginal cell is considerably shorter, and the second submarginal is less narrowed above.

The recurrent nervures join the second submarginal cell equally distant from base and apex, and the second recurrent is much nearer the end of the cell than in *florisomne*. The head and thorax are more finely and closely punctured than in *florisomne* or *nigricorne*.

Chelostoma (*Formicapis*) *neomexicanum* Ckll.

This was described in Canadian Entomologist, 1904, p. 13. Sladen's *Formicapis clypeata* is the same species. The first recurrent nervure meets the first intercubitus, or goes slightly before or behind it. The clypeus has a median longitudinal groove. The basal nervure exactly meets the nervulus in a Colorado (Florissant) specimen, and in Sladen's Alberta specimen, but in the Manitoba example the basal nervure falls a very little short of the nervulus. The head in the Alberta specimen is larger than in the others. *Autochelostoma* and *Formicapis* may stand as subgenera.

Supplementary Note on Formicapis.

In Peaceful Valley, Colorado, June 18, at flowers of strawberry, Miss Dorothy Young took the hitherto unknown male of *Chelostoma neomexicanum* Ckll. It is about 6.5 mm. long, with dense subapressed dull white hair on face, and pale reddish hair on front vertex and dorsum of thorax. The flagellum is slender, simple, faintly reddish beneath. The venter of the abdomen is simple, the third segment with a median line of hair, the fourth with the margin slightly and very broadly excavated in middle. The apex presents a pair of rounded, very obtuse lobes, close together, and a low dentiform structure on each side. The first recurrent nervure meets the intercubitus or is even a little basad of it. Sladen describes the maxillary palpi as 3-jointed; I have not made a microscopic mount, but I can see three cylindrical joints, and think there is a fourth immovable one.

The male emphasizes the distinction from *Chelostoma*, and I now think we must accept *Formicapis* as a genus, the species becoming *Formicapis neomexicana* (Ckll). The venation and smaller stigma readily distinguish it from Robertson's *Prochelostoma*.—T. D. A. Cockerell, Aug. 14.

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[2]*C. nigricorne* cannot be called by Panzer's name *fuliginosa*, as that was published under *Apis*, and was preoccupied.

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POPULAR AND PRACTICAL ENTOMOLOGY

The Scarab: Emblem of Eternity

BY J. S. WADE.

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While it is probable that most well informed people know in a vague, misty way that the emblem of the sacred beetle, held in high veneration by the ancient Egyptians, is identifiable in some way with the religious beliefs of that people, yet it is rather unusual to find any one who is able readily to give a clear explanation of the significance of the device. Perhaps this is due in some degree to the great variation of design and the consequent element of uncertainty which has existed among some Egyptologists as to the most probable meaning of this symbol. In view of this uncertainty, and of the perennial human interest attached to this matter, it is proposed here to review very briefly some of the most readily available data relating to the subject.

In Egypt the little objects of stone, pottery, emerald, green feldspar, obsidian, or other material, carved into various forms representative of a beetle, and engraven around the circumference or upon the bases with various devices, ornamental or hieroglyphic in character, may be considered as among the most common objects of art which have come down to us from antiquity, and they invariably excite the interest of the most casual traveler in that ancient land. There is much variety displayed in the form of these, as some are button-shaped, others are cylindrical, with or without a ring of gold or silver around the edge, while one form considerably used in Egyptian religions, especially upon the mummies of the period of the New Kingdom, appears with outstretched wings or bearing the head and horns of a ram.

The great majority of the emblems however are shaped to represent a beetle of the Coleopterous family Scarabaeidae, and this form is universally known as "the Scarab". It has been named for the black beetle, *Ateuchus sacer,* the metallic colored *Scarabaeus Aegyptiorum,* or related species numerous in the Mediterranean countries, and especially common in Egypt. These are closely related to the American *Canthon laevis* Drury, often seen along country roads and pathways, rolling tiny balls of excrementitous matter from place to place, hence popularly known in this country as "the tumble-bug".

The Egyptian name of the insect "kheperer," "khepari," or "khopi(r)." signified "become" or "create," likewise the substantive "phenomenon" or "marvel". In the form of "kheperi" the emblem was dedicated to the sun-god at Heliopolis, and from the temple at that place came the colossal granite scarab now in the British Museum. It was believed by the Egyptians that no female of the species existed but that the male, contravening the laws of generation, himself produced the egg and by his own act perpetuated the existence of the

species, therefore the scarab became a type of self-begotten deities and in particular of the god Kheperi who typified the rising sun.

In Egypt some of these little emblems were used as amulets, others were used as seals, while still others, like medals, were made to commemorate historical events. We are informed by Egyptologists that the soil of that country literally teems with them. They are often turned up while ploughing, and immense quantities have been found by antiquaries, under a variety of conditions, in thousands of tombs, especially those located along the banks of the Nile from Aswan to El Ariah and Alexandria.

Curiously enough, the range in date of these little scarabs appears to be greater than that of any other class of inscribed monument; some of the older of them appearing to go back to the very dawn of history. To the data gleaned from inscriptions on such scarabs Egyptologists are indebted for the possession of much information of great value regarding the earlier dynasties. Further, they afford valuable clues to the student of ancient art in that they illustrate variations in styles during the different reigns and the inscriptions furnish facts of great value regarding customs and manners of the people in those far away times. Probably the most interesting and valuable of all the scarabs are those bearing the royal arms of the various dynasties. Various famous rulers were mentioned in these inscriptions upon scarabs of a date long subsequent to the periods of their reign. These range from Cheops of the IVth to the end of the XXVIth dynasty. During the reign of Amenophis III about 1450 B. C., a large number comprising in all five varieties of fine large scarabs were engraven and all were inscribed with names of this king and his queen Taia and those of her parentage—the latter possibly possessing a whimsical interest as a side light from hoary antiquity upon the mind of the eternal feminine.

It is to be expected that these Egyptian scarabs would be carried in trade to most of the near by countries, hence, it is not remarkable that they are found in occasional numbers on most of the islands and shores of the eastern Mediterranean, of Mesopotamia, and of Greece. The scarabs and their meaning were well known to the Jewish people and the reference in Hab. 2:11 translated as "beam" in the 1611 Authorized Version of the Bible has been interpreted in the Septuagent and Vulgate as "Scarabaeus". The forms of the Egyptian scarab have inspired some of the finest Etruscan gems of the sixth and fifth centuries B. C. and they have suggested some remarkable and interesting forgeries in more recent years.

As there has been a great deal of discussion of the origin and meanings of the devices of some of these scarabs, so there has been, as is usually the case, the utmost variation of opinion. The limits of this paper forbid a detailed discussion of the various interpretations which have been promulgated. It will be sufficient to indicate that they are of very unequal value; some of them being too trivial for serious consideration, while others of them being brought together from the writings of remote antiquity and representing the results of prolonged study may therefore be duly accredited. While there is no doubt that there has been considerable variation in the significance of the scarab at different periods and under different conditions of Egyptian history, its primary and enduring significance undoubtedly was that of a religious emblem denoting the reincarna-

tion of the body or the immortality of the soul. There are abundant evidences of the truth of this for there are to be found numerous instances in which the emblem was used and worn by the Egyptians in a manner not unlike that of some Christian people of today in wearing a crucifix or cross as an emblem of their religion and of the God they worship. Plutarch has directed attention to the fact that the *Hermitybics Calasiries*, the soldiery of Egypt, each carried a ring upon which this beetle was inscribed. It is also known that these soldiers, just before going into battle, placed scarabs around their necks. True to habit a variety of probable explanations of this procedure also has been made, though it appears most probable that the Egyptians may have used these emblems for markers as aids in identifying bodies of the slain and as a preliminary to the rites of burial.

The use of scarabs as seals was very extensive, especially in the Middle Kingdom (beginning Cir. 3000 B. C.) and New Kingdom (beginning Cir. 1700 B. C.) The seal type of scarab is not only extremely abundant, but the sculpture represents an almost endless variety of design. In some instances apparently the original design was executed with great care and exactness and afterwards was unskillfully copied by ignorant engravers until the original meaning was lost. It is of interest to study the meaning of some of these mottoes, ranging as they do from references to deities, magical devices and places, down to hints of good cheer and friendly wishes, such as, "Memphis is mighty forever," "Mut give thee long life", or "Bubastis grant a good year". Some scarabs made of amethyst were shaped with bases flat and with desgins engraven thereon in intaglio and were pierced longitudinally for threading or for a swivel. While these probably were intended principally for seals, they might also be used as beads, necklaces, or other ornaments.

Not only did the nobles and other military and higher classes wear the sacred Scarab in a variety of forms about their persons, but there are abundant evidences to show that the lower classes of the population were equally devout. The emblems undoubtedly were adopted universally both in life and in death. They are found in greatest profusion painted upon and as emblems within the coffins of the dead both of the higher and of the lower classes. A large stone scarab upon which was engraved chapter 54 of "The Book of the Dead", often was placed in the bandages of the mummy. This was in the form of a written appeal that the heart of the dead person might not betray him when he came into judgment before Osiris. By virtue of this amulet the deceased was enabled to pass the ordeal of the "weighing of the heart" at the final judgment. A number of scarabs as well as actual specimens of the various species of beetles were placed here and there over the body, and a winged scarab frequently of very hard stone and skillful workmanship often was laid upon the breast. Not infrequently the heart was removed during the process of embalmment and the emblem substituted in the cavity. They may be seen sculptured on funeral tablets buried with the bodies, or on the ornaments of the ring, the necklace, or in pendants attached to them, or in a veritable multiplicity of arrangements.

It is obvious to an entomologist that the rather striking habits of this beetle would be the source of many superstitions among ignorant and credulous people such as were the fellahs of the Nile. One can picture something of the simple wonder with which they watched the actions of the beetle, working busily,

always in pairs, along the cattle path or upon the sandy slope of a hillside pasture on a sunny afternoon, compacting, coating with dust, or transporting its pellet by pushing it backward with its hind legs, with great diligence and patience, through all manner of difficulties until placed in the desired spot. Whatever the Egyptians may have understood concerning its habits and its life history, which greatly resemble that of our common *Canthon*, it is known that they held the little insect in highest veneration, compared its tiny globe to the sun, and they builded up much fanciful superstition about it. Pliny has stated that it relieved the eye of fatigue to gaze upon the golden green *Ateuchus Aegyptiorum* of Latreille, a notable variety found widely in Egypt and Nubia. Several nearly related species of the present genus *Ateuchus* also were objects of veneration, and about thirty species have been described thus far from Africa.

It is at once interesting, and pathetic, to study the thought underlying the positions in which some of these Scarabaei most commonly were placed upon the mummies: They may be found most often on the chest next to the flesh and underneath the eye lids, the scarab in this position probably being most significant to them as representative of life and animation; symbolic that the heart some time would resume its pulsations and that the eye some time would flash again. The humble insect placed in these positions is overwhelmingly indicative of some kind of belief by them that a time would come when the heart would indeed throb again, and the eye truly regain its sight, and when the body would be reanimated and the soul having completed its term of transmigration would again return to the body in resurrection or would take on a new being in immortality.

The anthropologist, trained to sensitiveness in apprehension of every clue pointing however faintly or dimly toward great principles, is swift to heed and deduce the larger meaning of this overwhelming impulse manifested in the people of that far away time who used the little scarab as an emblem of the deathless desire and hope in them, and in mankind, and which has had so many other manifestations through the centuries, all pointing toward one interpretation.

In studying the scarab, and something of what it has meant in times past to these people and to humanity, one may be reminded of a statement from the pen of Ingalls in discussion of a lecture heard by him upon the evidences of immortality. The speaker had held the rapt and breathless attention of an immense audience comprising all that was cultured, brilliant, and renowned of a city while "he dwelt with remarkable effectiveness and power upon the fact that nowhere in nature, from the highest to the lowest, was an instinct, an impulse, a desire implanted, but that ultimately were found the conditions and opportunities for its fullest realization." He instanced the wild fowl which, moved by some mysterious impulse, start on their prodigious migration from the frozen fens of the north and reach at last the shining south and the summer seas; the fish which, from the tropic gulfs, seek their spawning grounds in the cool bright rivers of the north; the bees which find in the garniture of the fields and forests the treasures with which they store their cells, and even the wolf, the lion, and the tiger, that are provided with their prey. Turning to humanity he alluded to the brevity of life; its incompleteness; its aimless, random and fragmentary careers; its tragedies, its injustices, its sorrows and separations.

Then he referred to the unsatiable hunger for knowledge; the efforts of the unconquerable mind to penetrate the mysteries of the future, its capacity to comprehend infinity and eternity, its desire for the companionship of the departed, its unquenchable aspirations for immortality, and he asked: "Why should God keep faith with the beast, the bee, the fish, and the fowl, and cheat man?"

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TWO NEW SPECIES OF ACHORUTES (COLLEMBOLA)

BY CHARLES MACNAMARA.

Arnprior, Ont.

When acquaintances, only pretending, I fear, to a polite interest in my hobby, ask me where I find snowfleas, my answer is: "Everywhere." Any winter day when the temperature is 25 degrees F. or higher, once you get away from the precincts of the town these hardy minute insects are almost sure to be found on the snow over large tracts of country, sometimes sparingly and sometimes in incredibly vast numbers. When they are relatively few, any one species of the half-dozen regular snow frequenters may be in the majority. But when they are many, it is invariably teeming hosts of *Achorutes socialis* Uzel that speckle the snow over whole townships and perhaps counties. Although these tremendous outbreaks are very interesting for the collector they have a serious drawback. While they are in progress it is rarely possible to find any species on the snow except *socialis*. Others are certainly there, but as to the unaided eye all snowfleas are little more than black specks on the white surface, the others are indistinguishable among the innumerable swarms of *A. socialis*. It is worse than looking for a needle in a hay stack. It is like looking for one particular straw in a whole lot of straw stacks.

But it is only the logically impossible that never happens. (And since Einstein has made parallel lines meet, even this seemingly safe proposition may not be incontrovertible.) The merely improbable, no matter how improbable, is sure to occur some time or another. And so it was in the midst of a vast issue of *Achorutes socialis* that a hitherto unknown member of the Collembolan snow fauna was discovered.

The date, 12th Dec., 1920, as far as I can remember, marked no very significant event in human affairs. But for some reason or other it was a most important day for the snowfleas of my district, and some common instinct had

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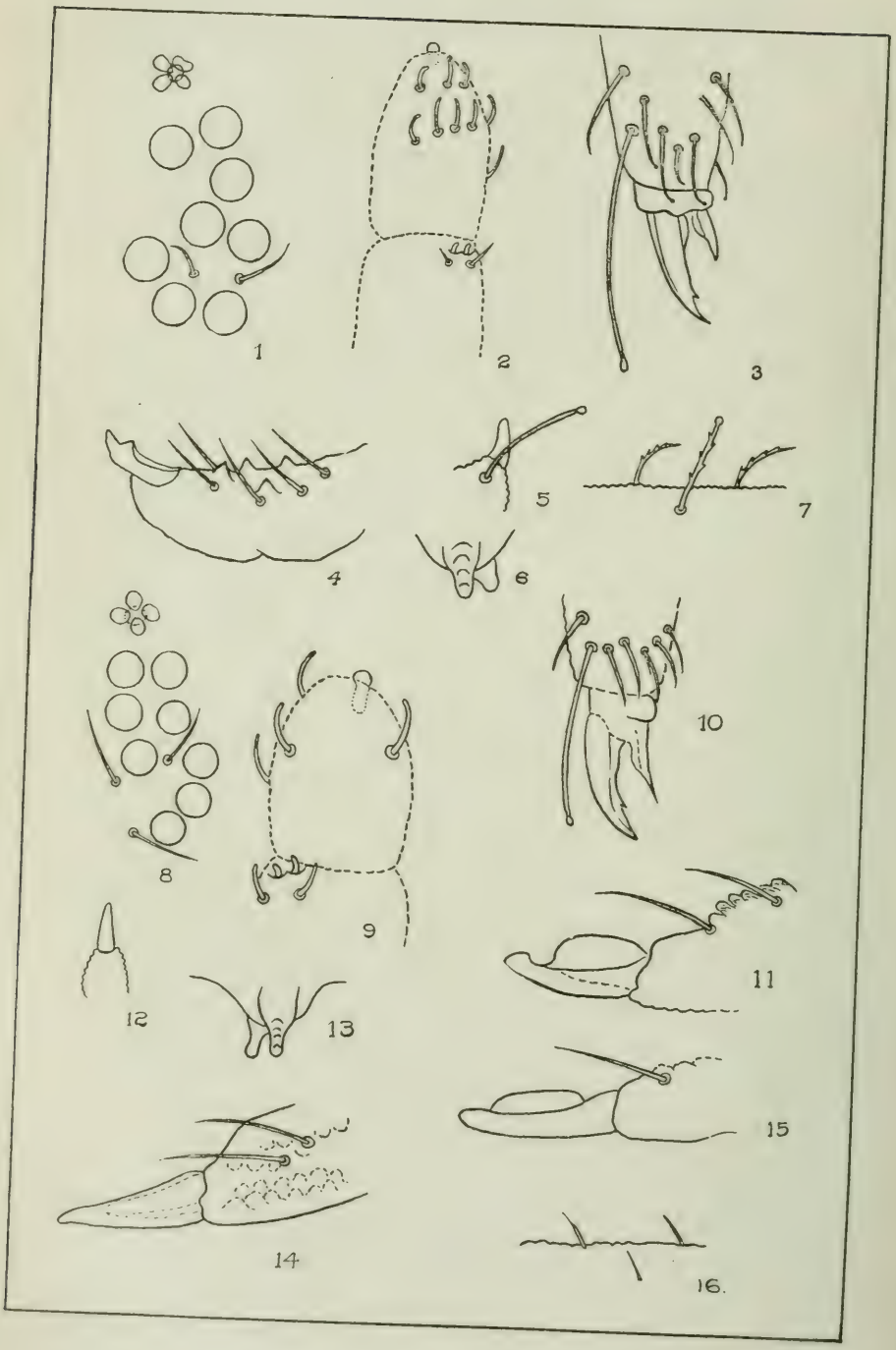
PLATE 2.



NEW SPECIES OF ACHORUTES

moved thousands of millions of them to come to the surface. My walk that day was in the Nopiming Game Reserve, a small wild life sanctuary of some 2,000 acres established on the shores of the Ottawa near Arnprior. (And although he is not usually classed as a wild animal, it is for the entomologist also a blessed refuge, where he can go about his collecting unafraid that a rash hunter will shoot him for a deer, or that the reckless small boy with the deadly "22" may mistake him for a chipmunk.) The day was calm with light clouds and the ground was covered with four inches of hard snow, making fine walking. There were no signs of thawing anywhere, the temperature ranging from 25 degrees F. in the morning to not higher than 30 degrees F. in the afternoon. Although this was a little lower than usual optimum temperature for snowfleas, the insects were out in greater number than I had ever seen them before, and a remarkable feature of the emergence was their wide and even distribution.

They were not, as I have often seen them, slowly oozing in blue black masses from crevices of rotten logs, nor were they patching tree trunks in close corporations that looked like plaques of dark blue powder, nor were they blackening the snow for yards around rotten stumps. Congregated at no particular foci, they were evenly dispersed everywhere. And everywhere is the right word. Averaging perhaps five or ten to the square foot, they were all through the woods and swamps,—a little thicker in the open hardwoods than among the conifers, for they always move towards the light—they were all over the ice of creeks and beaver meadows, and had spread across fields and clearances. They had even travelled to a considerable distance out on to the frozen surface of the Ottawa River. I do not know how many thousands of acres they may have covered, for I did not reach their southern or eastern boundaries, but they were distributed with very fair uniformity over the six or eight miles I walked through them, and I imagine they must have extended a long distance beyond the limits of the Game Reserve.

Every few yards I would stop and look at the snow. It was always sprinkled with the black specks moving with the stolid aimless deliberation characteristic of *Achorutes*. The *Isotoma* species are much brisker and more nervous in their habit. After walking thus through several miles of snowfleas, I got tired looking at them, but at last there came a slight break in the monotony. As I crossed a field and approached the uplift of a low terrace edged by an outcrop of rock that marked some ancient beach of the Ottawa, I paused once more to look at the eternal *Achorutes* at my feet. And there I noticed among the many, a few, blue black like the rest, but much smaller than any of the others. A late generation of *A. socialis*, I thought, or one that has not thriven like their more portly brethren. However, as this is the only variation I have seen all day, better pick up a few.

At night the half dozen or so specimens collected were duly preserved and labelled, but were not studied until a month later. They were then seen to be a new species, curiously combining some of the diagnostic features of both *Achorutes socialis* and *A. packardi*. Of course, I immediately wanted more of them, and at the first chance hurried off to the rocky ridge, where with unusual

good fortune, I found them again. Later, in February and March, I discovered them around the roots of beeches in a neighboring wood; and in April I sifted a few out of moss on the rocks where they first appeared. They were never in great numbers, and it usually took about an hour's steady search to gather in a dozen individuals.

Achorutes nothus n. sp.

Color dark blue; cuticle finely tuberculate. Eyes (fig. 1) eight on each side. Postantennal organ (fig. 1) with four peripheral tubercules. Antennae three-quarters length of head; segments as 5: 15: 15: 22; at apex clavate protrusible sense organ (fig. 2) and nine or ten "olfactory" hairs; on outer side of third segment distally a small organ of two curving rods with two stout guard hairs (fig. 2). Unguis (fig. 3) long, curving, unidentate on inner margin one third from tip. Unguiculus not quite half as long as unguis; broad lamella at base, apex sharp rounded. One tenent hair feebly knobbed surpassing end of unguis. Distally on tibiotarsus several knobbed hairs bent apically. Dens (fig. 4) short and stout, swollen and rounded apically with four or five conical teeth dorsally; mucro inserted on inner side of apex of dens, one quarter length of dens, apically slightly curved with one large tooth as fig. 4. Anal spines (fig. 5) one third length of hind unguis on low papillae. Tenaculum (fig. 6) quadridenticulate. Clothing (fig. 7) stout curving serrate setae, and long capitate setae with a few small serrations, those on posterior segments more strongly knobbed than those towards head. Maximum length 1 mm. Found on snow November to March; and in moss on rocks in April, at Arnprior, Ontario, Canada.

Dr. J. W. Folsom, who kindly examined these insects for me, points out that the claws, anal spines, and furcula closely resemble the corresponding organs of *Achorutes socialis*, but the teeth on the dentes are fewer and do not shade off into smaller teeth as in *socialis*. The clothing of serrate and capitate hairs however is very like that of *Achorutes packardi*, a species which rarely if ever comes out on the snow, although sometimes to be found in midwinter under bark or walking around on stumps.

In the field *Achorutes nothus* may be distinguished by its small size, but this is no great distinction, as *A. socialis* of 1 mm. in length are also not infrequently seen on the snow.

The other new *Achorutes* here described was forwarded to me by the Dominion Entomologist for identification, having been sent into the Entomological Branch by Mr. Ricker, of Monteith, Ont. They were collected by the Monteith station agent, Mr. J. D. Allen, from a space of a few square feet on his lawn, where they appeared in such numbers that nearly half a cupfull was gathered with the aid of a spoon. They had apparently come out of the soil, as Mr. Allen tells me there was no rotten wood or debris in the vicinity that might have sheltered them.

And alas! how often must the innocent suffer with the guilty. The harmless *Achorutes* was sacrificed for the evil deeds of the cutworm and the locust. Having in mind the destructiveness of insects in general, Mr. Allen was doubtless alarmed for his lawn when he saw this horde of *Achorutes*. He writes in 1921:

"The balance of the insects were destroyed with coal-oil, and to date have not noticed any more."

Achorutes pannosus n. sp.

Color dark blue; as material was received in bad condition cannot say if uniform or mottled. Cuticle finely tuberculate. Eyes (fig. 8) eight on each side. Postantennal organ (fig. 8) with four peripheral tubercules. Antennae four-fifths length of head; segments as 5: 10: 10: 15; at apex protrusible clavate sense organ (fig. 9); also five or six curved "olfactory" hairs; distally on outer side of third segment, a small sense organ of two short curving "pegs" in little pits with two stout curved guard-hairs (fig. 9). Unguis (fig. 10) stout, curving, unidentate in apical third. Unguiculus acuminate, about half as long as unguis. Tenent hair, one with small knob, not extending to end of unguis. Dentes two and one-half times as long as manubrium, with large dorsal tubercules distally. Mucro (fig. 11) one third length of dens, hooked apically with wide lamella or in a small percentage of specimens, not hooked apically with narrow lamella as in fig. 15. Anal spines (fig. 12) one third length of hind unguis, on prominent papillae about same length as spine. Tenaculum (fig. 13) quadridenticulate. Clothing (fig. 16) a very few short simple setae. Maximum length 1 mm.

Achorutes pannosus comes close *A. maturus* Fols. but differs in the presence of large dorsal tubercules on the dentes, broader base of unguiculus, longer anal spines, and in the shape of the mucro, as well as some other minor differences. The species also approaches the European *A. manubrialis* Tullb. but is separated from the latter principally by differences in mucrones, unguiculus and postantennal organ.

EXPLANATION OF PLATE 2

Fig. 1. *Achorutes nothus,* eyes and postantennal organ of left side, x 570.
" 2. " " olfactory hairs and sense organs of right antenna x 400.
" 3. " " right hind foot x 500.
" 4. " " lateral aspect of dens and mucro x 420.
" 5. " " left anal spine x 500.
" 6. " " tenaculum x 560.
" 7. " " clothing of first abdominal segment x 480.
" 8. *Achorutes pannosus,* eyes and postantennal organ of right side x 600.
" 9. " " olfactory hairs and sense organs of left antenna x 600.
" 10. " " right hind foot x 530.
" 11. " " lateral aspect mucro and dens, principal type, x 1,000.
" 12. " " anal spine x 600.
" 13. " " tenaculum x 600.
" 14. " " dorsal aspect, variant form of mucro, x 1,000.
" 15. " " lateral aspect, variant form of mucro, x 1,000.
" 16. " " clothing of first abdominal segment x 500.

SEXUAL ATTRACTION OF THE FEMALE HESSIAN FLY* (PHYTOPHAGA DESTRUCTOR SAY)

BY W. B. CARTWRIGHT,

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An accidental observation on April 2, 1921, at Centralia, Illinois, prompted a short study of the field activity of the male Hessian fly. On this date a female fly, emerging from a flaxseed partially covered by mud, became entangled and stuck, but was not so hidden as to evade the courtship of a number of male flies. A miniature swarm attended the female. Three and four males made offers of copulation at the same time while others stood facing the female or walking and flying impetuously about until an opportunity came to replace the ones in closer touch with her.

Following the clue given by the helpless female fly, several small cylindrical cages one inch in diameter and three inches tall were stocked with newly emerged females of known age, care being taken to obtain individuals which were still soft, uncolored, and unfertilized. Five females were imprisoned in each cage and the cages placed on the surface of the ground in the field as desired.

Observation 1.

Five cages containing females were placed in the field. Over each cage was placed a larger wire cage three inches in diameter and ten inches tall painted with tanglefoot. These cages were placed at 9 a. m., April 2, and the males excited by the presence of the females, were caught, counted and removed as shown in Table 1. The females were left undisturbed until the males failed to be attracted. On April 4 only one female fly was alive in each cage and the following day all were dead.

Table 1.

Date	Hour	Cage 1	Cage 2	Cage 3	Cage 4	Cage 5	Total
Apr. 2	10 a. m.	43	159	43	99	86	430
	11 a. m.	50	103	51	60	138	402
	4 p. m.	42	91	80	39	20	272
Apr. 3	9 a. m.	190	140	240	145	87	802
	11 a. m.	142	81	126	109	43	501
	4 p. m.	11	15	12	32	10	80
Apr. 4	9 a. m.	57	126	118	169	80	550
	11 a. m.	46	61	56	40	18	221
	4 p. m.	9	8	29	6	3	55
Apr. 5	9 a. m.	93	32	17	47	45	234
	11 a. m.	0	0	0	0	0	0
	4 p. m.	0	0	0	0	0	0
Apr. 6	9 a. m.	24	15	5	17	3	64
	11 a. m.	0	0	0	0	0	0
	4 p. m.	1	0	0	1	3	5
Apr. 7	9 a. m.	0	1	1	1	8	11
	11 a. m.	0	0	0	0	0	0
	4 p. m.	0	0	0	0	0	0
Total		708	832	778	765	554	3627

The results show that an average of 145 males were attracted for each of the 25 females confined. In the case of the five females in Cage 2, a maximum average of 166 males per female was obtained and in Cage 5 a minimum average

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of 109 males per female was obtained. It was noted during the observation that the males advanced against the wind and the advance was made slowly from a general assembly area a short distance from the females. The attraction to all cages continued even after all females were dead. The greatest number of males were caught on the cages just above the ground surface, thence upward for three inches. The activity of the males was most manifest early in the morning.

Observation 2.

To determine the area of attraction and the limits of the zone of advance or assembly, three cages, numbered 1, 2, and 3, were placed in the field in separated places. Concentric circles were marked around all the cages with radii one to fifteen feet. The leeward arcs of ninety degrees were the observational limits of cages 1 and 2. For cage 1 the arcs were set with screen wire painted with tanglefoot and for cage 2 set with tanglefoot painted in one inch strips on the ground. For cage 3 the concentric circles were used for points of position only, the observations being centered on the side of the sector set with tanglefoot screens enclosing an arc of forty-five degrees on the leeward side of the cage. The observation started at 10 a. m., April 3, and ended the same day at 3 p. m. The number of males caught in the tanglefoot at one foot intervals from one to fifteen feet, is shown in Table 2.

Table 2.

Distance	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Cage 1	35	15	2	4	18	12	3	0	0	0	0	0	0	0	0	89
Cage 2	35	25	37	26	42	40	10	9	4	2	7	5	3	1	0	246
Cage 3	87	116	18	15	10	4	4	8	7	1	0	0	0	0	0	270
Males caught—																
Total	175	156	57	45	70	56	17	17	11	3	7	5	3	1	0	605

Males within fifteen feet of the females were apparently attracted and definitely so within ten feet. The zone of assembly was particularly outlined from one to six feet from the females.

During the time the cages were run in both observations the wind was in a constant south and south-west direction with a velocity of six to eight miles per hour and a maximum not over twelve. Fly emergence in the field was at its maximum intensity for the season and the weather clear and warm.

A NEW PARASITE OF THE SPRUCE BUDWORM (HYM).

BY S. A. ROHWER,

U. S. Bureau of Entomology, Washington, D. C.

The following description of a new species of *Phytodietus,* reared by Mr. A. B. Baird as a parasite of the spruce budworm, is presented at this time so the name may be used in a forthcoming paper dealing with this moth.

Phytodietus fumiferanae new species

Allied to *Phytodictus annulatus* (Provancher) from which it may be distinguished by longer postocellar line, dark hind legs and different colored coxae of the male.

Female.—Length, 8 mm.; length of antenna, 8.5 mm.; length of ovipositor beyond abdomen, 3.5 mm. Slender; clypeus depressed medianly along anterior

margin, which is slightly emarginate; area between eyes but little higher than broad; eyes nearly parallel within; face finely granular, frons more finely so; postocellar line nearly twice as long as the ocellocular line; depressed areas of scutellum and metanotum without sculpture; propodeum shining with a faint median depression; anterior basitarsus about two-thirds the length of their tibia; calcaria of hind tibia but little less than half as long as hind basitarsus; abdomen shining, the second tergite but little longer than the third. Black; palpi, mandibles (except apices), small spot on inner superior orbits, usual spots on scutum, tegulae, small spot below hind wings, two small spots of anterior margin of scutellum and a larger posterior spot, median spot of metanotum, interrupted V-shaped line on posterior face of propodeum, and narrow apical margins of tergites, whitish; legs rufous; trochanters whitish; basal part of hind trochanters, hind femur, except rufous mark beneath, hind tibiae except extreme white base, and hind tarsi black; wings hyaline, iridescent, venation dark brown, stigma yellowish medianly.

Male.—Length, about 7 mm.; length of antenna, about 8 mm. Differs in color from the female as follows: head below antennae, scape beneath, proepisternum and lower lateral margin of pronotum, four anterior coxae, mesosternum and lower part of mesepisternum, yellowish-white; hind coxae black above, yellowish-white beneath.

Type locality.—Lillooet, British Columbia. Described from two females (one type) and one male (allotype) reared by A. B. Baird from cocoons collected July 11, 1919. The male issued in the laboratory February 7, 1920, and the females February 9, 1920.

Host.—Spruce budworm, *Tortrix fumiferana* Clemens.

Type and *allotype.*—Cat. No. 23068 U. S. N. M.

Paratype.—Canadian National Collection.

Notes on Coccidae. IX. (Hemiptera)[1].

BY G. F. FERRIS,
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The present classification of the genera of the subfamily Coccinae (or Lecaniinae) is based for the greater part upon the nature of the secretions and only to a small extent upon the morphological characters of the insects themselves. Some justification for this is to be found in the fact that the secretions present a wide range of form while in the more conspicuous features of their morphology the many species of the subfamily are, with but few exceptions, extraordinarily conservative. However, I can not believe that any really satisfactory classification can be arrived at until an exhaustive study of the insects themselves has been made and the facts thus obtained have been correlated as far as may be with the more easily observable facts of habit and character of the secretions.

On the other hand, I am somewhat inclined to believe that a complete correlation of this sort can not be obtained for it seems probable that some of the differences in the nature of the secretions are in part due to differences

[1]Continued from Canadian Entomologist, 53: 95, (1921).

in the physiology of the insects and not in their structure. In such cases it would seem entirely proper to give due consideration to such factors in attempting to arrive at a natural arrangement of the species.

Genus *Takahashia* Ckll.

The original description of this genus (as a subgenus of *Pulvinaria*) includes merely the following statement, "Similar to ordinary *Pulvinaria* in general structure but forming a very long, firm ovisac, which projects from the twig in a curve about 17 mm. long, carrying on its end the shriveled body of the female".

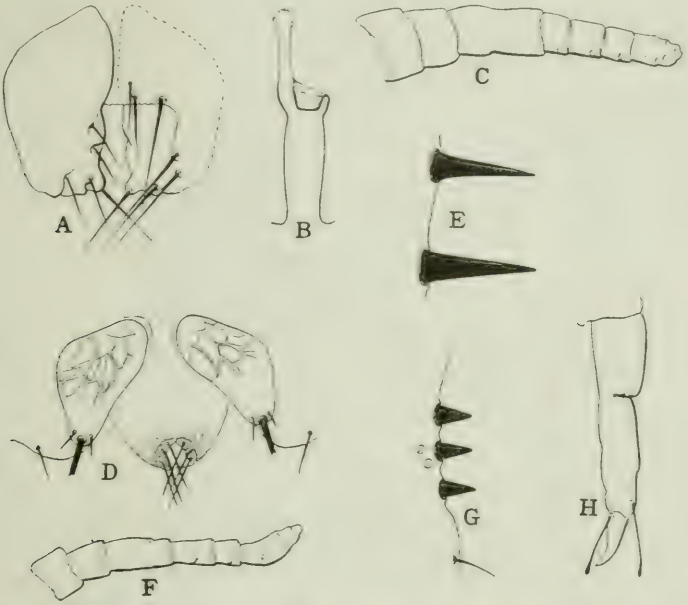

Fig. 1. *Takahashia japonica* Ckll.: A.—anal plates of adult; B,—tubular duct; C,—antenna of adult; D,—anal plates of first stage; E.—marginal setae of adult; F,—antennae of first stage; G,—stigmatic setae of firs stage; H.—anterior tarsus of adult.

I have at hand material of *T. japônica* Ckll. and *T. jaliscensis* Ckll., the former being the type of the genus. On the basis of the type species I would define the genus as follows.

Coccidae referable to the subfamily Coccinae (of the Fernald Catalogue); antennae and legs well developed, the former tending to be rather short; marginal setae present; stigmatic clefts practically obsolete, the stigmatic setae but little or not at all differentiated; anal plates of ordinary form, anal ring with eight setae; derm remaining membranous at maturity, beset dorsally with relatively few, simple pores and a few small, tubular ducts, ventrally with great numbers of circular, multilocular pores and tubular ducts. In life with the dorsum practically bare of secretion; at maturity secreting an ovisac.

On the basis of this characterization *T. jaliscensis* Ckll. could not be referred to this genus for the dorsum is beset with numerous small, 8-shaped pores. However, until a better understanding of generic limits has been attained it may well remain here. *T. citricola* Kuwana, as far as I can see, is simply a

Pulvinaria, having the stigmatic setae strongly developed as in the latter genus.

Whether *Takahashia* can really be maintained as distinct from some of the other genera of the same general type, such as *Lichtensia* and *Philephedra,* is a matter that will require much further study to settle.

Takahashia japonica Ckll. (Fig. 1.)

Material Examined. From various hosts in Japan, being the material recorded in Kuwana in 1902.

Notes. The antennae (Fig. 1C) are well developed but rather short and stout. The legs are likewise well developed, although rather small, the tarsal claw and digitules quite slender. According to Cockerell the anterior tarsi are apparently two-segmented. While this condition appears to be quite constant, it appears to be due merely to a fold and not to a genuine segmentation (Fig. 1H). The marginal setae (Fig. 1E) are quite large, stout and sharply pointed and are arranged in a definite single row. The stigmatic setae, if differentiated at all seem only to be slightly stouter, and at times slightly smaller than the marginal setae. The anal plates (Fig. 1A) are of quite ordinary form, but somewhat variable. The ventral side of the body in the abdominal region bears great numbers of circular, multilocular pores and a sub-marginal zone of crowded, tubular ducts of the type shown in Fig. 1B.

The first stage has the antennae (Fig. 1F) rather slender, five-segmented. The marginal setae are very few, small and filiform and the stigmatic setae, three in each group, are small, stout, conical and equal. The anal plates (Fig. 1D) are somewhat reticulate.

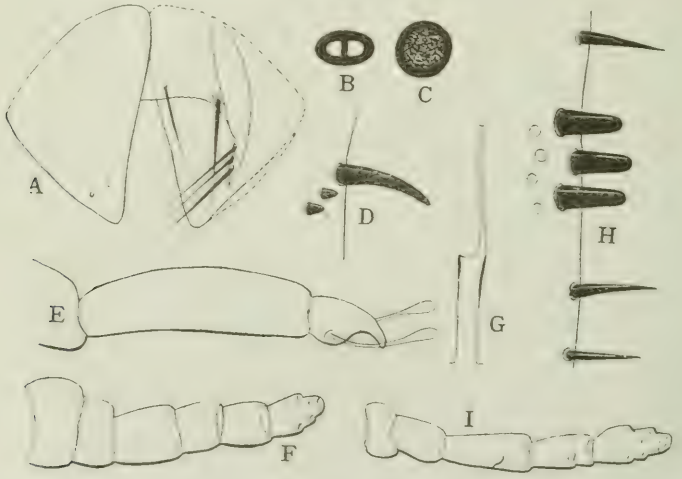

Fig. 2. *Takahashia jaliscensis* Ckll.: A,—anal plates of adult; B,—S-shaped pore from dorsum; C,—circular pore from dorsum; D,—stigmatic setae of first stage; E,—anterior tarsus of adult; F, antenna of adult; G,—tubular duct; H,—stigmatic setae of adult; I,—antenna of first stage.

Takahashia jaliscensis Ckll. (Fig. 2).

Material Examined. A slide mount, labeled "type" received through the kindness of Professor Cockerell.

Notes. This species resembles *T. japonica* in having the antennae (Fig. 2F) rather short and stout, but they have six instead of seven segments. The legs are much larger and stouter than in *japonica* and the claw (Fig. 2E) is stout. The tarsus is but little more than half as long as the tibia. The marginal spines are arranged in a definite single row, are rather stout, tapering and sharply pointed; the stigmatic depressions are very shallow, the stigmatic setae (Fig. 2H) short, stout, but slightly tapering, with blunt tips, subequal. The depressions are connected with the corresponding spiracles by a rather broad zone of circular pores. The anal plates (Fig. 2A) present no peculiarities.

The derm is membranous, beset dorsally with numerous very small, 8-shaped pores (Fig. 2B) and with larger, circular pores (Fig. 2C) which are concentrated in a median area, particularly in front of the anal plates. On the ventral side there are great numbers of circular, multilocular pores in the abdominal region, together with a zone of very small, tubular ducts (Fig. 2G).

The first stage larva has the antennae (Fig. 2I) rather slender, five segmented. The marginal setae appear to be lacking; the stigmatic depressions bear three setae of which the cephalic is quite large and long and the other two very small (Fig. 2D). The anal plates have very much the same form and appearance as in the adult but bear a very long apical seta.

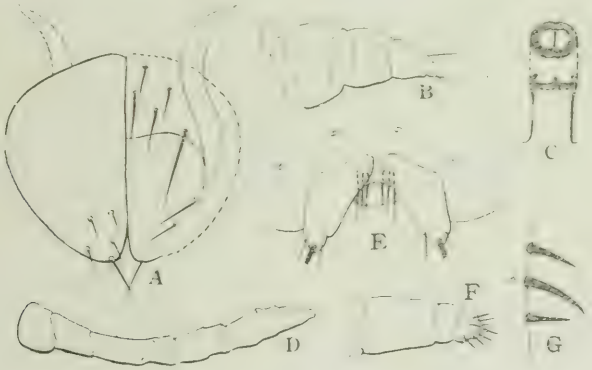

Fig. 3. *Pseudophillippia quaintancii* Ckll.: A,—anal plates of adult; B,—leg of adult; C,—8-shaped pore of dorsum of adult; D,—antenna of first stage; E,—anal plates of first stage; F,—antenna of adult; G,—stigmatic setae of first stage.

Genus *Pseudophillippia* Ckll.

The original description of this genus is merely the following: "A Lecaniine Coccid with, in the adult ♀, rudimentary legs and antennae; secreting a profusion of cottony matter, which completely covers and hides it. Skin not chitinous."

I rewrite this description as follows:

Coccidae referable to the subfamily Coccinae (of the Fernald Catalogue); with the antennae and legs very greatly reduced, but retaining their segmentation, the antennae apparently four-segmented; with the stigmatic depressions obsolete and the stigmatic setae lacking; without marginal setae; with the dorsum thickly beset with rather small, 8-shaped pores borne at the inner end of short ducts. In life with the dorsum thickly covered with fluffy, white secretion; not secreting an ovisac.

Pseudophillippia quaintancii Ckll. (Fig. 3).

Material Examined. From Pinus sp., Parksley, Virginia.

Notes. Antennae (Fig. 3F) very small, but with the segmentation fairly distinct, the specimens examined showing them as four-segmented. Legs (Fig. 3B) likewise very small but with the segmentation normal. Marginal setae and stigmatic setae apparently entirely lacking. Dorsal pores extremely abundant, upon careful examination showing as definitely 8-shaped and borne at the inner end of a short duct (Fig. 3C). Venter apparently without circular multilocular pores and with tubular ducts, if present at all, very few. Anal plates (Fig. 3A) roughly circular in outline, setae distributed as indicated in the figure. Derm but slighlty chitinized.

First stage with the antennae (Fig. 3D) quite slender, five-segmented. Derm beset with many small, 8-shaped, sessile pores, these arranged in transverse rows on the abdomen. Marginal setae very few and small; stigmatic setae three in each group, very small and slender, the median seta slightly longer than the others. Anal plates (Fig. 3E) of ordinary form.

Cryptostigma new genus.

Coccidae referable to the subfamily Coccinae(of the Fernald Catalogue); with the antennae and legs vestigial; spiracular depressions very deep and with the base surrounded by a conspicuous, heavily chitinized, crescentic dorsal plate which is thickly beset with small pores; spiracles very large, lying directly beneath these plates; stigmatic setae lacking, marginal setae present; derm for the most part membranous, beset dorsally with many minute, simple pores and ventrally with a relatively small number of multilocular pores; anal ring with ten setae. In life, as far as observed, with slight dorsal secretion and without an ovisac.

Type of the Genus. Cryptostigma ingae n sp.

Notes. The combination of characters given above distinguishes this genus very markedly from any other that has been described. The position of the spiracles, directly beneath the end of the stigmatic clefts is especially peculiar.

Cryptostigma ingae n. sp. (Fig. 4)

Type Host and Locality. From *Inga Laurina*, "guama," Lares, Porto Rico.

Habit. Occurring inside the hollow twigs, attended by an ant, *Myrmelachista ambigua ramulorum* Wheeler. In the specimens examined the dorsum bore but a small amount of secretion and there was no evidence of an ovisac. From each stigmatic cleft, however, there arises a thick pencil of white wax.

Morphological Characters. Length (on slide) 2.4 mm. Derm membranous throughout except for a narrow area encircling the anal plates and the plates at the base of the stigmatic clefts. Antennae (Fig. 4C) very small, indistinctly four-segmented. Legs reduced to unsegmented vestiges, which, however, still retain the claw (Fig. 4F). Plates at the base of the very deep stigmatic depressions (Fig. 4G) heavily chitinized and thickly beset with small pores. Spiracles very large. Marginal setae (Fig. 4E) small, conical, arranged in an irregular single row. Anal plates (Fig. 4B) relatively very large, together forming an elongate oval, each with several small setae above. The condition of the specimens does not permit the determination of the ventral charac-

ters of the plates. Anal ring very small, lying beneath the anal plates and apparently with ten setae. Dorsum with none but small, simple pores with chitinized rim. Venter with a relatively small number of circular, multilocular pores (Fig. 4D) in the genital region.

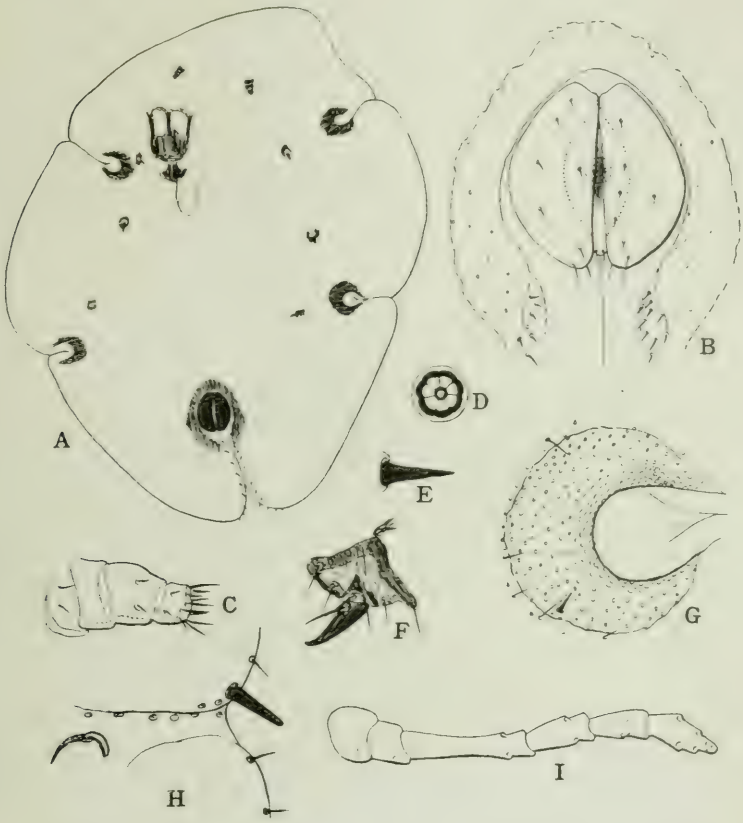

Fig. 4. *Cryptostigma ingae* n. sp.: A,—adult; B,—anal plates and surrounding region of adult; C,—antenna of adult; D,—circular pore of venter of adult; E,—marginal seta; F,—anterior leg of adult; G,—plate at base of stigmatic depression; H,—stigmatic depression and spiracle of first stage; I,—antenna of first stage.

First stage with the antennae (Fig. 4I) quite slender, six-segmented. Marginal setae extremely small, filiform, quite numerous. Spiracles close to the lateral margin, the stigmatic depressions well marked, with a single stout seta on the anterior margin. Anal plates set in a deep cleft, in general form much as in the adult but bearing a very long seta at the apex.

Notes. For the material of this interesting species I am indebted to Mr. G. N. Wolcott, Entomologist of the Insular Experiment Station at Rio Piedras, Porto Rico.

NEW SPECIES OF THE OLD GENUS LEPTURA AND ALLIED GENERA (COLEOP.)

BY RALPH HOPPING,

Dominion Entomological Branch, Vernon, B. C.

The flora of California is unique, in that most species are found only within the boundaries of the state and some are so localized as to occur only within the boundaries of one county. This is not confined to annuals and flowering shrubs. Many of the conifers and oaks are extremely local in their distribution, and are undoubtedly remnants of a former flora, which owing to sheltering circumstances or the adaptability of the individual has persisted and flourished under new conditions. It is, therefore, small wonder that the insect fauna presents many localized species, where so many different food plants exist with limited distribution.

For the past year Dr. J. M. Swaine and the author have been making an exhaustive study of the old genus *Leptura* as embraced by Henshaw's "Check List of the Coleoptera" and divided into 13 genera by Leng's "Catalogue of the Coleoptera of North America, North of Mexico." Pending the publication of this revision it seems advisable that the following new species be referred to under the generic name *Leptura*. These species seem very local in their distribution, as is no doubt the case with Van Dyke's *Leptura scapularis* and Fall's *L. subcostata* and *L. kernii* of all of which I have seen the types.

I wish to express my thanks to Mr. C. A. Frost of Framingham, Mass., for kindly comparing some of these specimens with the Le Conte types, and for his examination of *L. rhodopus* Lec. which, in Mr. Frost's opinion, is a distinct species with the legs reddish and not black as stated by Leng; although the original description states "feet bright ferruginous" the tarsi are black.

Leptura isabellae n. sp.

A small, robust species, entirely black except the elytra which are maculate; dorsal and ventral surface subopaque and rather closely covered with pale, coarse vestiture, longer on the head and prothorax.

The head coarsely, irregularly punctate, slightly narrower than the prothorax and moderately depressed between the eyes; antennae filiform three-fourths the entire length of the insect in the ♂, one-half that length in the ♀ and somewhat stouter.

The prothorax as wide as long; margins evenly rounded in outline, narrowing strongly at apex, anteriorly and posteriorly margined; anterior and posterior transverse impression feeble; basal angles subacute, pronotum coarsely punctate and strongly convex; intercoxal piece linear.

The elytra ferruginous, sparsely punctured, broader than the pronotum, gradually narrowed from base to apex; with black maculations, each elytron having a black, circular, noticeably concave spot at the posterior portion of the basal third, aproaching but not quite meeting the sutural margin, a black spot in the same relative position attaining the outer margin, a larger postmedian black spot, distant from the suture but extending to the outer margin, the suture,

outer margins and apices black, vesture sparse and coarse, pale on the ferruginous portions, black on the maculations; apices subtruncate.

The hind tibial spurs long; legs and antennae in ♂ longer than in ♀; metasternum bidentate in ♂; metepisternum sides parallel, broad (width one-third length); female stouter than male.

Length, ♂, 7 mm.; ♀, 8 mm.

Five males and two females examined, four (2 ♂ ♂ and 2 ♀ ♀) collected at Isabella, Kern Co., Calif., in 1913, two (♂ ♂) collected at Waltham Cr., Fresno Co., Calif., in 1907, and one ♂ given me by Mr. F. W. Nunenmacher, collected in Esmeralda Co., Nevada. The elytra of the Waltham Creek and Nevada specimens are testaceous instead of ferruginous, the Nevada specimen having also testaceous femora.

Type, a male in the Canadian National Collection, Ottawa; *Paratypes*, ♂ and ♀, in the collection of the author, all from Isabella, Calif.

This species should be placed probably just before *L. sexpilota*, from which it may easily be distinguished by the position and concavity of the basal, discoidal, black spot, the shorter form, and sparser vestiture.

Leptura isabellae seems to be found only in the semi desert regions of California and Nevada.

Leptura swainei n. sp.

A small stout species, opaque, black, except the legs and antennae, which are bicolored.

The head is coarsely punctate, slightly narrower than the prothorax with vestiture sparse and pale; antennae filiform, brown except the scape which is testaceous.

The prothorax is slightly longer than wide; vestiture long, sparse, pale and moderately fine; pronotum coarsely and irregularly punctate, sides subangulate just anterior to the middle, narrowing to the apex which is margined, basal margin canaliculate with channel shining; basal angles acute; intercoxal piece linear.

The elytra are black, opaque, with short black vestiture; the sides parallel; convexly rounding the apices, which are obliquely subtruncate.

The legs have the femora testaceous and tibia and tarsi brown; metepisternum wedge-shaped, metasternum not dentate in ♂. Length, ♂ 7.5 mm.; ♀ 8 mm.

Type, a male, in the Canadian National Collection, Ottawa; one *Paratype*, a female, is in the author's collection, both collected at Kaweah, Tulare Co., Calif., at an elevation of 1000 feet in the foothills of the Sierra Nevada Mts, by the author in 1892.

This species should come immediately after *L. sexpilota* but may easily be distinguished by its black elytra with short vestiture, shape of prothorax, elytra with convexly rounded apices, and absence of teeth on the metasternum of the male.

The female is larger and more robust than the male.

Leptura lucifera n. sp.

Of medium size, wholly black, except the elytra which are red; ventral

aspect shining; dorsal aspect feebly shining, with a peculiar dull sheen to the elytra.

The head is black, as wide as the prothorax, coarsely punctate, abruptly constricted behind the eyes, with transverse impression, front steep, strongly impressed between the antennae. Antennae black, two-thirds as long as body, scape enlarged at apex to twice the width of second segment, third and fourth segments linear, 5th widened at apex to twice its basal diameter and flattened, segments 6 to 11 wide and flattened.

The prothorax black, coarsely punctate, slightly and evenly narrowing to apex which is margined, basal angles obtuse, base not margined, bisinuate, with a short basal transverse impression, narrower than base of elytra; sides slightly constricted immediately anterior to basal angles; intercoxal piece narrow.

The elytra red, with well defined widely separated punctures, sides parallel, vestiture very short and sparse, apices transversely truncate, slightly dehiscent.

The metepisternum is broad, sides parallel, outer side margined. The legs are black, hind tibial spurs of medium length. The abdominal segments have sericeous vestiture on posterior margins. Length 13 mm.

Type, a male, in the Canadian National Collection; one *Paratype* in the collection of Mr. Wenzell. The type was collected in Cochise Co., Ariz., August 12, 1908, the paratype from the Jemez Mts., N. M. The prothorax is of the *L. sanguinea* type. The only near approach in color is *L. ignita* Sch., a very distinct species.

While this description was in manuscript Mr. H. W. Wenzel of Philadelphia sent me for examination 2 specimens of this genus from Jemez Mountains of New Mexico, one of which seems unquestionably to be a male of Col. Casey's *Leptura haldemanni,* and the other a smaller female (10 mm.) of the above described *L. lucifera.* As both specimens were caught at the same time and place, one a male and one a female there is a suggestion that *L. lucifera* may be the female of *L. haldemanni*; but aside from the entirely different color which occurs in other species like *L. laetifica* the punctation of the elytra is so utterly diffent that I have decided to let this species stand until we can prove it is or is not the other sex. Mr. Wenzel's specimen from New Mexico seems identical except for size and I have made it a paratype.

Anthophilax liebecki n. sp.

Robust, entirely black except the rufous elytra with apices black.

The head has moderate shallow punctures, and is strongly constricted immediately behind the eyes; the eyes large, distinctly, strongly emarginate, head not sulcate as in some species, antennae filiform, segments 1 to 4 piceous, 5 to 11 griseous.

The thorax is strongly angulate, constricted and strongly margined anteriorly and posteriorly, punctures coarse, pronotum sulcate.

The elytra are rufous, sparsely, distinctly punctured with sparse golden vestiture; apices black, truncate. Male type.

Stouter, pronotum with lateral, median, obtuse tubercle, female.

The male, length, 12 m.m., width, 4½ m.m.; the female, length, 14 mm.; width, 7 mm.

Habitat, Texas, two specimens ♂ and ♀.

Type, a male in the National Collection at Ottawa, and *Paratype*, a female in the collection of Mr. Chas. Liebeck of Philadelphia, through whose kindness I was able to describe this species.

This is a very robust species, being shorter in proportion than any other of our described species of *Anthophilax*. The brush-like sole of the first tarsal segment is darker than that of the second and third.

Anthophilax mirificus Bland.

Anthophilax venustus Bland, Proc. Ent. Soc. Phila. IV, 1865.
Pachyta costaricensis Bates, Bio. Cent. Am. Vol. 5, 1885.

I was much surprised, in going over the Biologia Centrali Americana, to find, under Fig. 1 on Plate XX of Vol. V, an exact reproduction of the male of our *Anthophilax mirificus* Bland under the name *Pachyta costaricensis*, nor can I find anything in the description to separate it from Bland's species. The locality is given as "Costa Rica, Volcan de Irazu, 6000 to 7000 feet (Rogers)". It would seem a far cry from the localities given by Nicolay[1], (Colo., Utah, Mont., Id., Ore., and Calif.) to Costa Rica.

However, the plate is such an exact reproduction and the size given by Bates so exactly the size of the males before me, that I have not the least doubt that they are the same species. This does not seem remarkable when it is recalled that species found in the southern United States are known to extend into Mexico and probably into Central America, as, for instance, *Ptychodes trilineatus* L., extending in its distribution from the southern United States to South America and even to Tahiti. Also many of our species found at comparatively low elevations in Alaska and British Columbia are also found in Colorado, New Mexico and Arizona at comparatively high elevations and may well extend into Mexico and Central America.

In looking up Bland's original descriptions I find that *A. venustus* was the male and not the female, as cited by recent authors and Leng's recent catalogue.

Bland says[2], "Body black, coarsely punctured; elytra rufous with black markings," and further on in the description, "Elytra rufous . . . . a circular black mark on the base, extending half way between the scutel and humeri, a small oblong black dot near the suture about one-sixth from the tip." Under *A. mirificus* he does not state the color of the elytra but his "anterior half grossly and rugosely punctured" sufficiently designates the female.

Leconte[3] seems to have recognized that Bland's *A. mirificus* was the female, "and the elytra punctured and rugose before the middle," in comparing it with *A. tenebrosus*.

In Nicolay's "Synopsis", already referred to, not one species of *Anthophilax* is given as occurring in Canada, nor do I find any mention of the

[1]Syn. of the Anth. of N. A. Jour. of N. Y. Ent. Soc. Vol. XXV Mch. 1917.
[2]Proc. of Ent. Soc. of Phila. 1865, p. 383.
[3]Smith Misc. Coll. XI. No. 264, 1873, p. 208.
[4]A Preliminary List of the Insect of the Province of Quebec, Pt. III, Coleop. 1917, p. 233.

genus occurring in Canada in Leng's "Catalogue." Mr. Chagnon[4] lists three species as occurring in Quebec, viz *A. attenuatus, malachiticus* and *viridis*. I have also before me *A. viridis* from Halifax, N. S., *A. malachiticus* from Eastern Ontario, *A. venustus* from Ontario, and three males and 11 females of *A. mirificus* from the Midday Valley near Merritt, B. C., and one male from Vernon, B. C., in the head of the Okanagan Valley.

Although Bland mentions that both his specimens described as *A. mirificus* and *A. venustus* may be sexes of the same species and were taken from the same tree he does not mention the tree species. In British Columbia they were found by my son George Hopping breeding in the western yellow pine (*Pinus ponderosa*) and emerging from trees killed by *Dendroctonus* several years before. Later Mr. Frank Sheriff of Melrose Highlands, Mass., and the writer, found three pairs in copulation under the bark of trees killed by *Dendroctonus* the previous summer. Several females were also found depositing their eggs in trees one year dead.

Prof. H. F. Wickham in his "List of the Coleop. of Canada" published in the Canadian Entomologist, lists three of the above species, and there are a number of references to captures, but the record of *A. mirificus* does not seem to appear in literature.

Typocerus gloriosus n. sp.

Ventral surface with legs rufous, except the prothorax black; dorsal surface with rufous antennae and pronotum; elytra yellow with black and brown bands and spots.

The head is narrower than the base of pronotum, finely, densely punctured, and sharply constricted rather far behind the eyes, gula black, vestiture golden, especially dense behind the eyes; antennae serrate and very stout and short.

The pronotum is about as long as wide, anterior transverse impression deep, posterior transverse impression not extending to basal angles, punctation coarse and only moderately close, longitudinal median impression broadly impressed, rufous.

The elytra are opaque with golden vestiture, darker on the black portions, moderately dense; punctures fine but not very closely placed; maculate, testaceous with basal testaceous spot, humeri light brown, basal band dark brown, median transverse oval spot black, subapical wide band black and apices black; the black maculations with nebulous brown margins apices emarginate. The legs and antennae are stout, even for this genus, and the unique specimen has the usual characters of the genus including the poriferous areas on the distal articles of the antennae.

The beautiful specimen was very kindly donated by Mr. Chas. Liebeck of Philadelphia. It has a slight resemblance to *T. balteatus*, but differs greatly since the latter is not nearly so robust, has the antennae more slender and black from the sixth segment distally, and the elytra are coarsely sparsely punctate, shining, with narrow black bands.

Type, a male, in the Canadian National Collection at Ottawa, from Ft. Wingate, New Mexico. Length, 13 mm.

OBITUARY NOTICE

Lachlan Gibbs.

The death occurred on March 1st, at his residence, Blackheath Park, London, Eng., of an Entomologist, beloved by a host of friends on both sides of the Atlantic. With his death the long line of Gibbs, who have been outstanding figures in Montreal, comes to an end, his forefathers having been connected with the Montreal firm of men's outfitters, Gibbs & Company, since its establishment in 1775, and represented for years in London under the firm name of Gibbs Bros.

Mr. Lachlan Gibbs was born in London in 1852 and was educated there. His first visit to Montreal was in 1874 and he at once sought out the few entomologists and became interested in the Montreal Branch of the Entomological Society of Ontario. The interest never slackened till the day of his passing away. He resided in Montreal but a few years, returning to England, but after several visits of a few months' duration on business and pleasure he took up his residence in Montreal in 1896, becoming manager of the firm, and making the city his headquarters till 1911—after which he made yearly visits to the city from London.

He was a member of the Church of England, and a keen churchman. While his residence was on the other side, he invariably arranged that his annual visits would synchronize with the meetings of the Synod here. He had an immense number of interests—commercial, artistic, musical and philanthropic—but in addition he had three hobbies—gardening, stamp collecting, and entomology. It is hard to say of which of these his heart was fondest. His garden was always a delight to visit—he always wanted to have others enjoy it, and to give roots, cuttings and seeds to everyone. His collection of stamps, particularly of the British Empire, was very valuable, and he presented a number of rare stamps to King Edward VII. for his collection. He made many collections of Lepidoptera, not for himself but to give to others—individuals and societies. The Blue Butterflies (*Lycaenae*) were always his favorites, and no trouble was too great for him to secure rare species and varieties and through his kindness a fine representation of variations of three of the British Blues was presented to the writer, and by him placed in the Lyman Entomological Room of McGill University, as well as a great many other interesting species. To quote from the "Entomologist", Vol. LV., p. 96: "When *Lycaena arion* turned up in Cornwall he wrote from Montreal to a friend in England that he was coming across on a certain steamer and to meet him at Exeter on a specified evening. He said, 'I must see that big blue alive.' They met, found the blue in numbers, and the same evening posted the majority of them alive to friends at a distance who, as he said, had not the opportunity of seeing the species for themselves. That was the man! It was never any question of exchange, he simply wished to give his friends a share of his own delights."

On his last visit to Canada in 1921 his friends all noticed a great change in his health and appearance, and he felt in bidding us good-bye that it would be his last voyage across the Atlantic. He was never a very robust man, but of wonderful energy and nervous activity, but latterly his strength failed him and he was doing too much for his bodily strength. The writer spent two days

at his delightful country home at Como, Que., to help him in his efforts to get our wood white butterfly, *Pieris napi* vars., across to the British Entomologists alive for purposes of cross breeding. We secured quantities of the eggs, which hatched before Mr. Gibbs sailed, but by preparing pots of cress plants ahead, and taking the menageries in his stateroom, he at last succeded in rearing many imagoes on British soil.

We had such long chats among the beautiful trees and fields of his lovely estate, about insects, flowers, and of entomologists of both sides of the Atlantic, living and dead, that our memory of our dear friend seems to tell us that he cannot really have passed out from our midst. To the members of the Montreal Branch he has always been a true friend indeed, and what more can one say. To know him was to love him.

He contributed little to the periodicals—perhaps the two articles in the Canadian Entomologist, Vol. XXV., 88 and 177, were the only ones from his pen —but his letters were full of valuable information and helpfulness. He became a fellow of the Entom. Society of London in 1913, and since 1884 belonged to the South London Ent. and Nat. Hist. Society. When he sailed from Montreal, he went home full of another purpose than that of the white butterflies or of his own failing health. It was to take his grandson on a trip to Scotland, to the scenes of his early pleasures with the Burnet moths. In spite of his enfeebled condition and at the age of 70 he accomplished his purpose. They went to Braemar and found *Zygaena exulans* flying. They crossed into Argyleshire and again found *Z. achilleae*, and returned much elated with their success. His delight was in helping others to enjoy the wonders of nature—and particularly the younger people of both sexes. When on his death bed and almost too weak to speak he said to Mr. R. Adkin, P.E.S., who was called to him before he passed away: "Do encourage the youngsters to take up Entomology; it has been such a help to me."

He was laid to rest in Charlton Cemetery on a beautiful spring day such as he would have loved.—A. F. W.

A CORRECTION.

I find that the name *Argyroploce deceptana* McD. (Can. Ent. 1922, LIV, 42) is preoccupied by *A. deceptana* Kft. I propose therefore to replace it by *Argyroploce apateticana* n.n.

Mailed Thursday, October 12th.

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POPULAR AND PRACTICAL ENTOMOLOGY

OCCURRENCE AND CONTROL OF THE CORN EAR WORM IN ALFALFA.*

BY WALTER H. LARRIMER,

Scientific Assistant, U. S. Bureau of Entomology, West Lafayette, Indiana.

Occurrence.—During the season of 1921, over the central states, the corn ear worm (*Heliothis obsoleta* Fabr.) was generally more abundant than for many years. Late in the season it had become a very serious pest indeed to the various commonly attacked food plants but was especially destructive in young alfalfa fields. This latter habit, while commonly observed in the western country, especially the southwest, can be considered rare for the east central states, especially the northern portion. It was with considerable surprise then that larvae of this species were observed as many as thirty or forty to the square yard in young alfalfa fields and also in fall sown rye.

Such an infestation occurred in a young alfalfa field near St. Joseph, Michigan, and at the time observed, October 3, practically every leaf had been stripped from the young plants. The bare stems remaining caused the field to look at first glance like a clean stubble field. As the injured plants attempted to put out new leaves, half a dozen hungry worms were found waiting to devour each new bud. At least 99 per cent. of these larvae were of this species, there being an occasional fall army worm (*Laphygma frugiperda* Sm. & Abb.) and rarely a velvety specimen of the cotton cut worm (*Prodenia ornithogalli* Guen.)

Control—One batch of poison bran mash made up of 25 lbs. of bran, ¾ lb. Paris green, 2 quarts molasses and about 3 gallons of water was mixed and applied to 5 acres, the remainder of the field being used for a check. The mash was scattered at noon of October 3 and the early afternoon was clear though cool. At 5 o'clock it began to rain, rained all night and was raining at 11 a.m. on the 4th when the experiment was first examined. At this time on the treated area, practically every worm, regardless of the rain, was lying either curled or extended on the ground and 75 per cent. of them were dead. On the check plot not a single worm was on the ground. All of them were crawling about on the alfalfa stems either in search of food or most probably to keep out of the water on the ground caused by the falling rain.

This cool rainy period was followed by warm sunshiny weather and the larvae which survived the first treatment, even though a small per cent. of the extremely heavy original infestation, were able to threaten some damage to certain portions of the field. Therefore, a week after the first treatment, it was decided to treat some portions of the field a second time, including that portion left as a check on the first treatment. Unfortunately, the second application

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met with the same fate as the first: a continuous rain having set in the evening of the day the poison was applied. However, the results were very good indeed, and comparatively few worms survived the second treatment

Conclusion—Immediately after the second treatment the young alfalfa plants began putting out new buds and later growth enabled them to go into winter in fair shape. Larvae which were taken to be *H. obsoleta* and *L. frugiperda* were reared and the adults thus obtained were later determined by Dr. Dyar as the respective species to which they had been assigned.

Considering the unexpected and extremely unfavorable conditions of these experiments, the success of the control obtained is rather remarkable. Good results were obtained under very adverse conditions and given a fair chance, control of the corn ear worm in young alfalfa can be very likely secured by a single thorough application of poison bran mash.

NEW COLEOPTERA, X.

BY H. C. FALL,

Tyngsboro, Mass.

Among a number of species of Coleoptera recently collected at Baldur, Manitoba, by Mr. Norman Criddle and sent me for identification, occurred the following: *Bembidion scudderi* Hawyd, *B henshawi* Hawyd., *B. salinarium* Csy., *Tachys vittiger* Lec., and *Anthicus californicus* Laf. The fact is mentioned to call attention to the very considerable extension of the known range of these species. This is most notable in the case of *T. vittiger*, which has hitherto been recorded only from the Pacific Coast line; I have however specimens from the Salton Sea in the Colorado Desert of California. All the other species mentioned above are known to frequent the alkaline flats of the Salt Lake region in Utah, and their occurrence in Manitoba is at once a commentary on the physical character of the country where they were found. Mr. Criddle has since informed me that they were taken on the shore of a large alkaline pond.

Two other species of *Bembidion* taken by Mr. Criddle on the shores of this same pond will probably prove to be partial if not peculiar to such situations. One of these considerably resembles, and is evidently allied to, *B. constrictum* Say, so common along the Atlantic sea coast, and may be Casey's *sociale* or *particeps*, though not conforming entirely to the description of either. The other appears to be an undescribed species belonging to the small tripunctate group, and allied rather closely to *henshawi*, with which it may be compared as follows.

Bembidion obtusidens n. sp.

Color precisely as in *henshawi*, viz., head and thorax black with distinct green bronze lustre; elytra pale testaceous, each with a small dot or fuscous spot in the position of the first and third dorsal punctures, and between them a larger transverse spot more or less lunate or semicircular in form; body beneath black, slightly greenish, legs rufotestaceous. The size is larger and the form notably broader and less parallel than in *henshawi*; the thorax is nearly

similar in outline, but a little more transverse; the elytra relatively broader, and more shining than is the rule in *henshawi*, though with a detectable alutaceous sculpture. In *henshawi* the mentum tooth is triangular, in the present species broadly arcuate or arcuato-truncate. Length 5 to 6 mm., width, 2.05 to 2.35 mm.

The type is a male collected by Mr. Norman Criddle at Baldur, Manitoba. I have also examples from Aweme, Manitoba; Laramie, Wyoming; and Lagoon, Utah.

It seems not to have been noticed that the name *Bembidion grandiceps* Haywd., covers two quite different forms. These are both present in the Le Conte and Horn collections, and though not recognized as such by Hayward, I believe them to be specifically distinct. In the true *grandiceps* the head and thorax are larger and relatively wider, and the posteriorly oblique sides of the thorax almost attain the angles, the latter being scarcely right, with the sides before them subparallel for an extremely short distance. The type, as indicated by Hayward, is in the Horn collection, and Dr. Skinner writes me that it bears the state label "Tex.," with the name label in Hayward's hand. In the Le Conte collection there are two "Tex." specimens, and a third, the one on the label, bears a yellow locality disk, indicating that it was taken in the central Mississippi Valley (Illinois?). In my own collection are two examples from Berryton, Kansas.

The other form may be described in a few words as follows.

Bembidion rolandi n. sp.

Similar in nearly all respects to *grandiceps*, but distinguished at once by the relatively smaller and more elongate head and thorax, the sides of the latter straight, and parallel at the hind angles for a distance greater than one-sixth the entire basal width, the angles sharply rectangular or extremely nearly so. This species is, so far as I am aware, confined to the Atlantic slope, specimens having been seen from New York (Ithaca), eastern Pennsylvania, and the District of Columbia. The type is from "E. Park" Penn., a suburb of Phila.

Bembidion semiaureum n. sp.

This name is proposed for a very large form of the *fuscicrus* type which has stood for years in my collection awaiting in vain the possible advent of intermediates which might connect it with the latter species. The color is nearly as in *fuscicrus*, viz.—head and thorax greenish black, polished; elytra testaceous with an oval fuscous discal spot which begins at the anterior dorsal puncture and extends somewhat to the rear of the posterior puncture; it is limited laterally at the fifth stria, and continued to base by a rather broad parallel sutural stripe, which involves the first two interspaces. There is no indication of a lateral extension of the fuscous spot, as is frequently the case in *fuscicrus*. The body beneath is black, legs entirely rufotestaceous. The prothorax is rather less narrowed behind than in *fuscicrus*, the base being only just perceptibly narrower than the apex. Length 6.2 to 7 mm.
Humboldt Co., California (Van Dyke).

Fuscicrus is a conspicuously smaller and somewhat narrower species, rarely much exceeding 5 mm. in length, the thorax smaller and more narrowed basally, the fuscous elytral spot smaller, with manifest tendency to be extended laterally, even in some cases to the side margins; the hind femora often more or less piceous. Specimens in my collection from Ft. Yukon and Rampart, Alaska, are undoubtedly Mannerheim's *lucidum* var. b," to which Motschulsky gave the name *fuscicrus,* and are, moreover, quite inseparable from Wyoming and Colorado specimens at hand, to which the names *caducum, albidipenne* and perhaps others of Casey's recent Revision are applicable.

Two undescribed specimens of *Dyschirius* have been sent me from Manitoba by Mr. Criddle and Mr. Wallis, one of which was taken at Baldur on the shores of the alkaline pond already referred to. These may be described as follows.

Dyschirius interior n. sp.

Closely allied to the Californian *tridentatus* Lec., with which it must be associated because of the wide elytra margined at base, and the clypeus tridentate. The form is very distinctly narrower than in *tridentatus,* the legs rufous instead of nearly black, and the prothorax, elytral apex and body beneath show a more or less marked rufescence, the general color, however, being black with green bronze lustre. The front is transversely sulcate, the frontal crest nearly wanting. The third elytral interspace is tripunctate, all three punctures lying near the third stria. The apical protibial process is here a little longer than the terminal spur, while in *tridentatus* the reverse condition seems to prevail. Length 3.7 to 3.8 mm.

Four examples have been seen, all taken at Baldur, Manitoba by Messrs. Norman Criddle, J. B. Wallis, and L. W. Roberts.

Aside from *tridentatus,* the only other species in our fauna having the base of the elytra margined, the clypeus tridentate, and the third elytral interval tripunctate, is the Californian *varidens* Fall, a considerably smaller species (2.7 to 3 mm.) with more finely striate elytra.

Dyschirius perversus n. sp.

Elongate, parallel, thorax nearly as long as wide, feebly narrowed in front and scarcely perceptibly narrower than the elytra; color black with green bronze lustre, legs rufous. Front transversely impressed; elytral striae entire, finely but distinctly impressed except at the extreme base; striae moderately punctate; third interspace bipunctate, the first puncture near the base and virtually on the third stria, the other near the third stria at about the apical fifth. Front tibae subedentate externally. Length 4.8 mm; width 1.3 mm.

Described from a single example submitted by Mr. J. B. Wallis and bearing label, Miami, Manitoba, 16—VI—17.

By Le Conte's table (Bull. Brook. Ent. Soc. 1879) this species falls with *sphaericollis* and *edentulus. Sphaericollis* is larger, with a more transverse thorax and generally stouter form, and in it, as in its associates, it is the basal puncture of the third interspace that is lacking rather than the intermediate one. *Edentulus* is, I think, unknown to American students; at any rate its very large size—7 mm.—is sufficient to exclude it.

Listrochelus longiclavus n. sp.

Rather stout, oblong oval, a little broader behind, entirely rufotestaceous, the head and thorax with sparse erect hairs, elytra glabrous. Head densely punctate, the clypeus less densely so; clypeal margin broadly reflexed, arcuato-truncate, the angles rounded. Prothorax three-fifths as long as wide, sides nearly straight and parallel in basal two thirds, thence strongly convergent to apex, side margins barely perceptibly crenulate; surface uniformly punctate, the punctures distant on an average by their own diameters. Elytra slightly rugose and rather closely punctate. Length 11.3 to 12.3 mm.

Male.— Antennal club very elongate, nearly twice as long as the stem; ventral surface flattened, the sixth segment and the median parts of the fifth except at base, closely punctate; tarsi very slender, much longer than the tibiae, claws all similar, slender, with a small acute tooth at about the basal two-fifths. The entire inner edge of the claws is at first sight apparently unmodified, but under sufficient power is seen to be uniformly minutely pectinato-serrulate.

Described from two males from Eagle Pass, Texas, submitted by Mr. Warren Knaus. Type in the writer's collection, paratype in that of Mr. Knaus.

This species resembles in a general way *L. flavipennis*, but is of somewhat stouter form. The very long antennal club combined with the structure of the claws will distinguish it from any hitherto described species. The free angle of the hind coxae is not at all produced.

Macrobasis subglabra n. sp.

Form slender; entirely black; subglabrous; head and thorax sparsely finely punctate, elytra finely rugose, but not distinctly punctate. Head not widened toward the vertex; prothorax subquadrate with oblique front angles, dorsum with fine, feebly impressed median line. Antenae nearly as in *unicolor*, first joint not quite as long as the three following. Protibiae of male with two spurs. Length 7 to 10 mm.

Described from a series of ten specimens taken by Mr. F. S. Carr at Edmonton, Alberta, and a single example from Redvers, Saskatchewan, submitted by Mr. C. A. Frost. The type is an Edmonton male bearing date "9—VII—20."

This species is closely allied to *unicolor*, and with insufficient material might be suspected of being small, denuded specimens of the latter. Mr. Carr however, informs me that it is the commonest Meloide of his region, and that all examples are alike in appearance. Careful examination shows that there is a very fine, short, and sparse pubescence which is obscure in color on the disk, but a little paler near the margins. In *unicolor* the head is a little widened toward the vertex and therefore less quadrate than in the present species, the pubescence always distinct and dense enough to give a grayish aspect, the size averaging materially larger. The Le Conte collection contains two examples of this species from the Red River, placed with *unicolor*.

The types of all the above described species are contained in the author's collection; paratypes of *B. obtusidens* and *M. subglabra* in the Canadian National Collection.

LIST OF NATURAL ENEMIES OF THE CELERY LEAF-TYER (PHLYCTAENIA RUBIGALIS GUEN).[1]

BY F. H. CHITTENDEN,

U. S. Bureau of Entomology, Washington, D. C.

Having recently received the manuscripts of a paper on the celery leaf-tyer in its occurrence in California, the writer finds that the author, Mr. Roy. E. Campbell, Bureau of Entomology, has observed only two parasites in his State, and as several species are unrecorded, it seems advisable to bring together a list of these in one short paper, especially in view of the fact that at the time that the author's first paper on this leaf-tyer was published in Bulletin 27, Division of Entomology, in 1893, only a single enemy was known. All of the species which are here listed are parasites.

Synetaeris sp.—This ichneumonid was identified with its host in 1898 at Livonia, Pa. (Identification by Dr. Ashmead).

Pimplidea sanguineipes Cress.—This species was reared from the greenhouse leaf-tyer, February 15, 1916, by Mr. B. L. Boyden, Oxnard, Calif. (Determination by Mr. Cushman).

Rogas rufocoxalis Gahan—Reared in November 11, 1918, Alhambra, Calif., by Mr. R. E. Campbell. (Identified by Mr. A. B. Gahan).

Campoplex (*Omorgus*) *phthorimaeae* Cush.—Reared by Mr. Boyden at Oxnard, Calif., October 18, 1915. (Identified by Mr. A. B. Gahan).

Microgaster congregatiformis Vier.—Reared by Mr. Boyden at Oxnard, Calif., October 18, 1915. (Identified by Mr. A. B. Gahan).

Amorphota infesta Cress.—This ichneumonid fly (Chttn. No. 140802) was raised from its host February 10, 1909, from material collected by Messrs. McMillan and Marsh at Smeltzer, Cal. (Determination by Mr. Viereck).

Meloborus sp.—Reared from its host from material collected by Messrs. Marsh, September 18, 1908, at Oxnard, Calif. (Determination by Mr. Viereck.)

Chalcidid—An imperfect specimen of a chalcidid, reared by Mr. Boyden at Oxnard, Calif., February 10, 1916, not determined.

Tetrastichinc (?)—A secondary parasite, bred on *Microgaster congregatiformis* Vier. as host by Mr. Boyden, Oxnard, Calif., February 15, 1916. (Identification by Mr. A. B. Gahan).

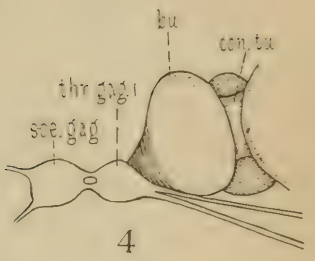
Trichogramma minutum Riley.—Reared by Mr. Boyden at Oxnard, Calif., March 14, 1916, as egg parasite. (Identified by Mr. A. A. Girault).

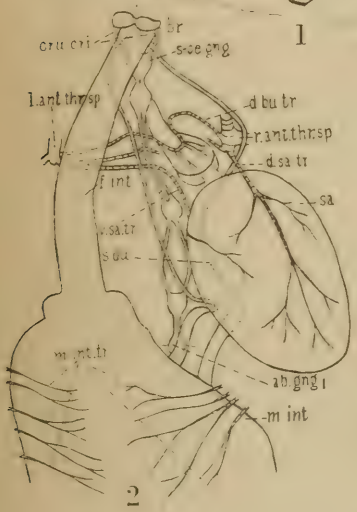
Syntomosphyrum modestus Houd.—An egg parasite raised by Mr. Boyden at Oxnard, Calif., March 14, 1916. (Identified by Mr. A. A. Girault).

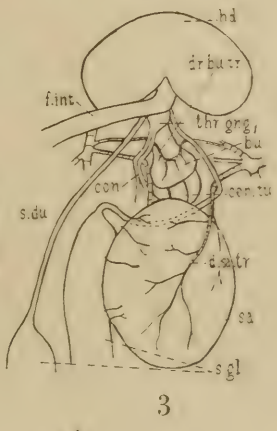
Dibrachys boucheanus Ratz.—Reared by Mr. Boyden at Oxnard, Calif., February 10, 1916. (Identified by Mr. A. B. Gahan).

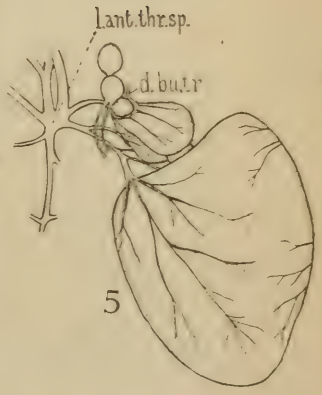
1—The American species, according to Mr. Carl Heinrich must be known by this name, *ferrugalis* Hbn., not occurring on this continent.

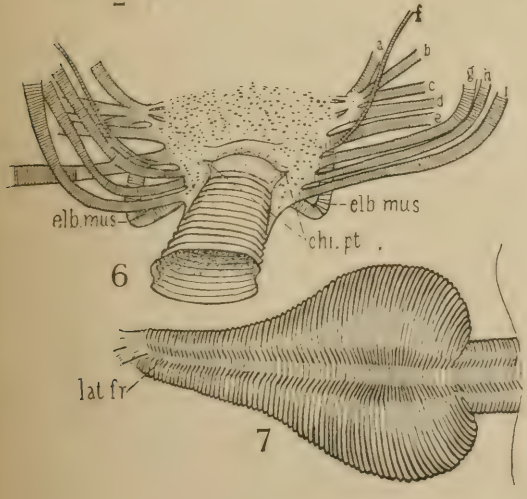
CAN. ENT. VOL. LIV. PLATE 3.

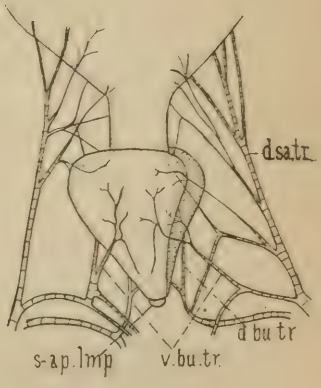












PROTHORACIC GLAND OF RED-HUMPED APPLE CATERPILLAR.

THE VENTRAL PROTHORACIC GLAND OF THE RED-HUMPED APPLE CATERPILLAR[1] (SCHIZURA CONCINNA SMITH & ABBOT).

BY J. D. DETWILER,

Western University, London, Ont.

In the summer of 1918 while engaged by Professor Herrick in making observation on *Schizura concinna*, my attention was attracted to the larva's power of ejecting a fluid from its body. A few experiments were made and the phenomenon presented such interesting phases that a somewhat detailed study of its general features was decided upon.

Nature and Source of Secretion.

The first experiment with the larva was a determination of the secretion's reaction towards litmus. A caterpillar was placed on strips of both red and blue litmus paper and mechanically irritated. A sudden reddening of the blue paper then took place showing plainly that the secretion was acidic. The ejection of the liquid was almost instantaneous, and being unacquainted with glands of this nature its source was not detected. An examination of the caterpillar's body revealed many small drops of liquid on its surface, suggesting as the source numerous hypodermal glands. A small sheet of blue litmus paper, was then notched and fitted over the caterpillar's body in the form of a yoke, so as to isolate or partition, one part of the body from the other. On irritating the caterpillar the paper was again reddened by the spray, but the body behind the paper partition remained dry. In this way the cephalic location of the gland was determined for, by close observation, after sufficiently disturbing the caterpillar, a fine spray of a clear liquid could be seen issuing from the ventro-cephalic region of the thorax. The odour of this secretion is very similar to that of vinegar and sufficiently strong to irritate the nasal passages.

Historical Sketch of Earlier Observations.

Comparatively few entomologists have noticed the occurrence of the secretion in this species, and only one localized its source.

The earliest record was made by Saunders of Canada, who in 1881 reported that when the larvae were handled they discharged from their bodies a transparent fluid of a strong acid odour. Six years later Denham observed that older larvae " had the power to emit quite a quantity of strong hydrochloric acid, strong enough to be decidedly corrosive to the skin and easily perceptible in the atmosphere." In 1895 Packard stated that while examining the very gaily colored and highly spined caterpillars, he observed that when a fully grown one was roughly seized with the forceps or fingers it sent out a shower of spray from each side of the prothoracic segment exactly like that of *Cerura* (*Harpyia*) *vinula*. In this article he also definitely credits himself with the discovery of the gland in this species. Foster in 1902 also noticed the secretion and described it

1.—A preliminary paper was published in the Annals. Ent. Soc. Amer. (1919) in conjunction with Professor Herrick and entitled. "Notes on the Repugatorial Glands of Certain Notodontid Caterpillars."

as a transparent watery fluid with the odour of sulphuric acid, and further that it exuded from the caterpillar's body wherever it was touched. So far no records have been found where the gland was actually observed.

Range and Ejection of Spray.

The result of the litmus paper test suggested a very promising method of detecting the extent to which the liquid could be ejected. Large sheets of blue paper were fastened together covering in all a space of about eighteen by twenty-two inches. A caterpillar was then placed in the centre and irritated. Directly a graphic representation of the extent of the spray was registered for the strong acid readily reddened the blue paper[2]. In this way it was found that the caterpillar could spray a considerable area at one operation, and that it appeared to have some directing sense and power. The most normal action, however, seems to be that of sending the spray backward over its body,—a natural direction since it is here that it is most likely to be attacked. Some idea of the area covered may be formed from the fact that a caterpillar has been observed by the writer to send the jet a distance of eight inches and also that the spray tends to spread out very considerably. The act of ejecting the liquid is quite characteristic and gives the caterpillar a somewhat formidable appearance. When strong mechanical irritation is applied,, for example, the head is thrown up, jerked to one side and a jet of clear liquid emitted through a small tongue-like organ momentarily protruded from the mid-ventral region of the neck. The ejection of fluid is almost instantaneous, resembling very much the emptying of a pipette when the rubber bulb is suddenly and forcibly squeezed.

General Form and Location of Gland.

The gland consists essentially of two divisions arranged in tandem and connected by a short tube. The anterior part is bulbous and relatively small, while the posterior one is sack-like and large[3] (fig. 1). The anterior and apical part of the bulb is connected by a short "false duct" to the external opening which is located in a ventro-medial position just behind the anterior margin of the prothoracic segment. The sack extends backward to the posterior border of the metathorax and rests to a large extent on the flattened anterior portion of the much enlarged mid-intestine. It will thus be seen that the whole organ passes somewhat diagonally through the entire length of the thorax and also that it occupies the major part of the space in this region of the body.

Position of Gland in Relation to Other Organs.

Normally, in insect anatomy, one finds that the oesophagus, after coming up through the nerve collar, passes backward in a medial direction to the mid-intestine. In this case, however, it is pushed to one side, usually to the left to make room for the gland which also arises in the middle line. This displacement

2—The article referred to in the previous foot-note describes a series of experiments subsequently carried out by this method and also a diagram of the actual range of the spray.

3—For convenience these two divisions will be referred to as "bulb" and "sack" respectively, it being understood that the terms are not necessarily significant of their functions.

may be so great as to radically change the symmetry of the intestinal tract here, causing the fore-intestine to connect with the mid-intestine considerably to one side (fig. 2.). In fact the junction has been observed to be so far to the left that the fore-intestine was quite in line with the left half of the mid-intestine.

The silk glands also suffer considerable displacement. Normally, one would expect to find them on their respective sides of the body since their ducts do not connect until they have passed the gland in front. But in *S. concinna* this is not their usual position, for both appear, as a rule, on the left side, their ducts passing forward on the same side until the vicinity of the bulb has been reached. This condition, however, may be reversed. When they are both on the same side the duct of the displaced gland in passing over to its proper side, before uniting with its fellow to form the single duct in front, usually keeps characteristically clear of the bulb (figs. 2 and 3). In only two instances has this duct been noticed passing across the front of the bulb. In one of these instances the glands were both on their respective sides of the body but the duct of the right gland on reaching the bulb passed to the left of it and then back again to the right side across the front of the bulb.

Even the nervous system may be forced to deviate from its mid-ventral course or even to modify its symmetry. In the first place the bulb, as it comes up from beneath the suboesophageal ganglion, tends to push the connectives to one side[4], almost invariably to the left[5] (fig. 2), and secondly, the prothoracic ganglion itself may be considerably distorted, its apex turned toward the left, due to the medial position of the bulb (fig. 4).

One can readily understand why the oesophagus, and to some extent also the nervous system, should give way to such a large organ tending to occupy the same position. It is difficult, however, to understand the shifting of the silk glands to the same side, thus necessitating a circuitous course of the duct in order to return to its normal position. Possibly a study of the development of the larva would explain this. From the varied positions that this gland may occupy with respect to the other organs, it appears to have reached an abnormal degree of development in this species.

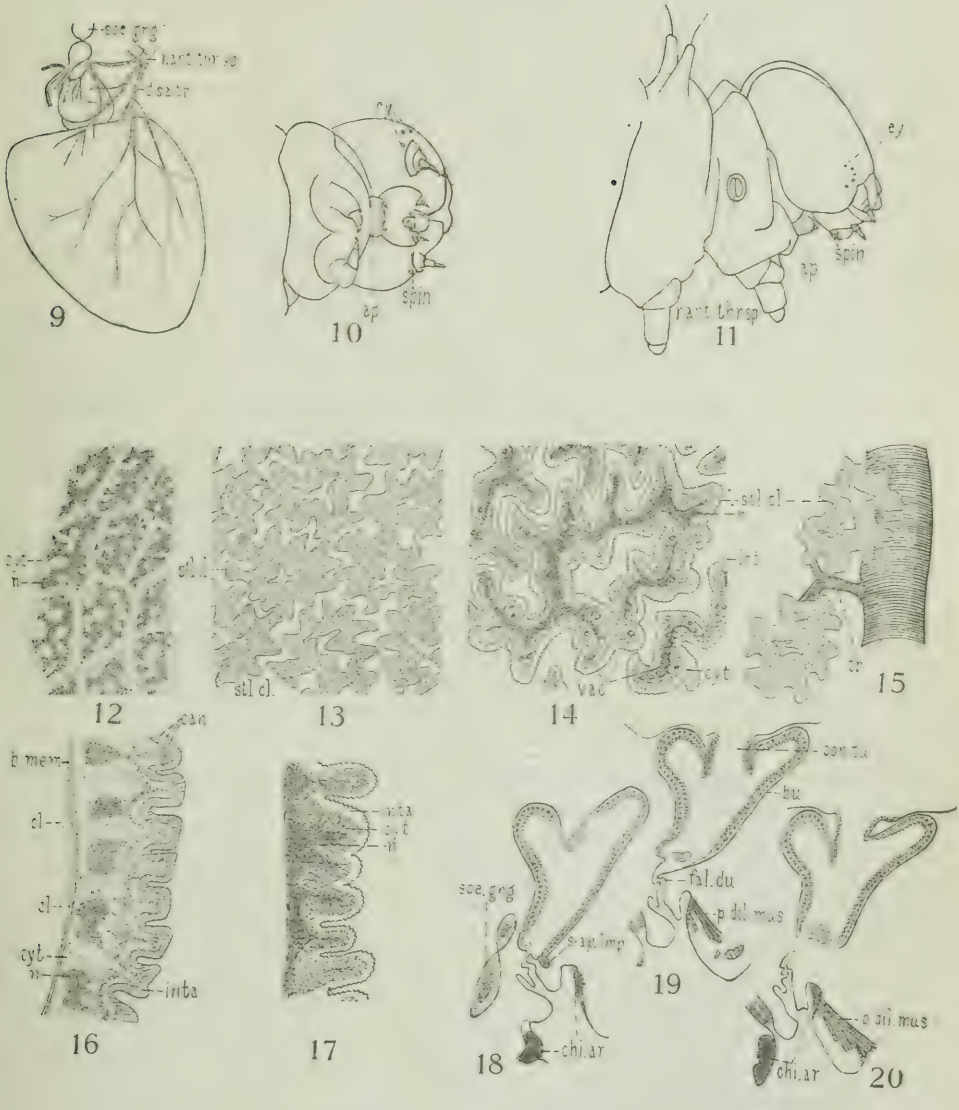
Tracheation.

The whole gland receives its oxygen supply from the anterior pair of thoracic spiracles. Two rather prominent branches, one from each side, issue from the mass of tracheae here and pass inward to the sack. On reaching it one branch goes to the dorsal surface and subdivides there while the other passes to the ventral half. On the principle of bilateral symmetry one would expect each branch to supply its respective lateral half. Almost invariably, however, the branch from the right side goes to the upper surface and the left one to the lower (figs. 2 and 3). In only one instance has this condition been found to be reversed. These two main branches may also contribute to the tracheal supply of the upper part of the bulb (fig. 8).

4—Dimmock, A. K. 1882, noticed a similar displacement in the cords of *Harpyia vinula* (an European species) and stated that it is more pronounced in the earlier stages. I have not investigated this phase of the problem in *S. concinna*.

5—As I recall, there was one instance where the cords passed the gland on the right.

CAN. ENT. VOL. LIV. PLATE 4.



PROTHORACIC GLAND OF RED-HUMPED APPLE CATERPILLAR.

The bulb receives its main supply from two pairs of branches, one pair going to the dorsal[6] surface and the other to the ventral. The former pair is somewhat interesting from the fact that it forms a continuous circuit across the dorsal surface of the bulb, making a broad loop here from which it sends off branches. In this way a continuous trachea passes from one side of the thorax to the other (fig. 2 d. bu. tr.). In some larvae the middle part of the loop is weakened and the branches come off in two main groups, but this grouping may also occur where there is no weakening of the loop (fig. 2). This condition is probably reminiscent of a time when each branch supplied its own side independently. The pair going to the ventral surface does not make a medial connection but each branch keeps to its own half, where it divides and subdivides normally (fig. 8).

From this it will be seen that each division of the gland is well supplied with tracheae, a provision quite significant when the function of each is considered. The tracheae also, very probably, perform a partial suspensorial function, there being no muscular attachment over the whole gland except at its anterior extremity. This accessory function may, in fact, have given rise to the continuous loop over the dorsal wall of the bulb. As to the peculiar disposition of the tracheae going to the sack, in which one branch or trunk supplies the dorsal half and the other the ventral, it seems reasonable to suppose that each does normally supply its own lateral half but that as a result of an extraordinary development of the gland, the sack has turned or fallen over to one side, the direction being almost invariably to the left. In fact this turning does not appear to have been quite complete, for the plane dividing the tracheated halves is not perfectly horizontal but inclines a little to one side, that is, to the right (fig. 3), showing that the leftward orientation is imperfect; nor does the direction of falling appear to be permanently established for, as noted above, the usual disposition of the right and left tracheal branches over the sack may be reversed. This theory of turning, due to extraordinary development, can, no doubt, be checked up by embryological studies, or perhaps even by examining the early-stage larvae. In support of the theory it might be stated that the writer has discovered homologous glands in a few species of the genus *Datana*, also Notodontids, in which the structures were so small that the elasticity of their own tissues would no doubt hold them in place. Their tracheation has, however, not been studied[7].

6—Although the bulb naturally stands more or less erect it will be considered, for descriptive convenience, as lying on the ventral body-wall and the antero-dorsal surface will be referred to as the dorsal surface. A similar consideration will apply to the other aspects of the bulb.

7—In dissecting a number of Datanas (*D. ministra*, *D. contracta*, *D. integerrima* and *D. angusii*) I found that they too possessed glands somewhat similar to that of *S. concinna*, but evidently very much simpler in structure. In testing the contents of the gland of *D. integerrima* it also was found to be acidic. I might here add that I also experimented with *Schizura unicornis* and found that it secreted an acid fluid and that the operation of the gland is practically the same as that of *S. concinna*. I have found no other record of ventral prothoracic glands in these species.

Musculature.

The musculature of the gland is somewhat remarkable in that it is wholly situated at its anterior end. As the individual muscles are small and close together, they can be studied best by pulling the gland backward so as to stretch this area, thus separating the muscles more or less[8]. When this is done they will be seen to be arranged in pairs (a muscle on one side having its corresponding muscle on the other) along the lateral margin of the organ beginning at the extreme cephalic end of the "false duct" and extending back a short distance beyond the apex of the bulb (fig. 6). At the extreme cephalic end of the "false duct" and just inside of the ventral body wall, there will be seen three pairs of muscles (fig. 6, a, b, c,) radiating from the ends of the transverse slit which constitutes the external opening. The anterior pair extends to the caudal margin of the head while the other two pairs pass laterad to the body-wall being attached close to the first pair of thoracic spiracles (fig. 11), one in front and the other below. Close to these muscles and appearing almost as lateral extensions of the duct is another pair (fig. 6, d). These are short and have their origin in the body-wall at a point about half way between the duct and the anterior spiracles. A short distance behind these and still in alignment with the lateral margin of the duct the fifth pair is inserted (fig. 6. e); these also extend to the body-wall, their origin being below and close to the spiracles just mentioned. From the point of insertion of each of these last mentioned muscles there arises a very slender muscle (fig. 6, f), the pair passing upward and outward to their origin on the caudal margin of the head. Accompanying this pair of muscles are three other pairs inserted one behind the other along the lateral margin of the apex of the bulb (fig. 6, g, h, i) and originating in the same area as the slender ones just mentioned. One pair still remains to be described (fig. 6, elb. mus.). They are characteristically elbowed and can be seen to good advantage when the gland is thrown forward. They will then appear as two miniature columns passing upward from the ventral body-wall, just behind and a little to each side of the apex of the bulb, and attached directly below the insertion of the most posterior of the three pairs of muscles just described. A short distance from their insertion they make a sharp bend (elbow) and pass downward to their origin close to and behind the posterior margin of the external opening. From this point they pass backward in their attachment along the body-wall to the ridge separating the first and second thoracic segments. They also appear to be more or less continuous with other ventral body-muscles. From the ventral position of these muscles it will be seen that they must be capable of relatively great extension when the head is thrown upward and the apex of bulb is forced forward. Their elbowed condition is then evidently nature's most convenient way of accommodating their length to the short space resulting when the caterpillar is undisturbed.

Morphology.

As mentioned before, the gland proper consists of two distinct divisions, one bulbous and the other saccular. The former is more or less pear-shaped

8—It will be necessary to first dissect away the mass of body muscles and tracheae that occupy this region of the thorax.

and distinctly bilobed at its larger end. This is due to two well defined lateral furrows, one on each side, which externally divide this structure into dorsal and ventral halves. These furrows not only traverse the whole length of the bulb, but also that of the short tube connecting the two divisions (fig. 7). The narrow apical end of the bulb widens somewhat laterally, and its walls show a dorsal and ventral pair of darkened areas, which are evidently heavily chitinized points for attachment of the muscles which were found inserted in this region (fig. 6, chi. pt.). The lumen of the bulb here also shows the lateral widening, the whole space ending rather abruptly, due to the truncated terminus of the bulb. In this somewhat abrupt terminal wall can be seen the true opening of the glands which consists in a transverse slit with whitened lips. It is called the "true" opening since it is this part of the gland that is protruded through the body-wall opening when the liquid is ejected. When thus protruded, two small, finger-like projections arise from the lateral angles of the anterior margin of the apex (figs. 10 and 11). These fold towards each other when the apex is withdrawn. On the ventral side of the apex is a small, median lump-like structure (figs. 8 and 18, s-ap. lmp.), which is white in color and by transmitted light appears to be hollow. Its white color contrasts rather strongly with the distinct yellow of the bulb.

Connecting the end of the bulb with the external opening is a short tube, which has been referred to as a "false duct," and which is really an infolding of the body-wall. This invagination of the body-wall evaginates when the apex of the bulb is forced out through the external opening. It is thus seen that the gland itself is not evaginable, but only the false duct. The anterior end of the false duct terminates with the more or less chitinized lips of the external opening. The anterior lip of this opening appears as a rather loose fold while the posterior one is thinner and discloses a small chamber when drawn back so as to separate the lips.

The form of the saccular division is best described by the name given, for it looks indeed like a sack. It is somewhat oblong, evidently favouring an ovoidal shape with the larger end nearer the bulb. Its shape, size and very white color, contrast strongly with the bulb.

Dimensions.

In order to form a more concrete idea of the size and relative proportions of the gland, a few of the more important dimensions will be given. In the dissections only final stage larvae were taken, and even here the measurements vary much, for during the instar very considerable growth takes place. In one dissection, the dimensions were as follows: total length of gland 6.5mm., length of sack 4.33 mm., width of sack 3.6 mm., and length of bulb 2.17 mm.[9] This was the largest gland of which a measurement was taken. In another dissection, the total gland in situ, occupied a space of 4.5 mm. in length. The apical end of the bulb narrows decidedly. Some idea of its size may be formed from measurements made of the part when extruded. In two caterpillars

9—Computed from drawing made to scale. In this case the connecting tube was concealed by the dorsal lobe of the bulb and hence no measurement is given for it.

these averaged approximately as follows: length 0.39 mm., width at tip 0.57 mm., width at base 0.82 mm.

From the size of the apex it will be apparent that the muscles concentrated there must be very small. The three pairs at the ends of the transverse, body-wall slit average approximately 0.026 mm. in cross-section, and they are relatively quite heavy. The slender ones mentioned in the discussion of the musculature are about 0.008 mm. in diameter. They are the lightest of the muscles connected with the gland.

Histology.

The hypodermal origin of the gland is very plainly shown in its histological structure. Lining the whole organ is the highly developed intima, which is so strong that the layer of overlying cells may be quite readily stripped off, leaving a well-formed skeleton of the whole organ.

In the bulb and connecting tube, this lining presents a strongly corrugated appearance, the corrugations running crosswise around these parts throughout their entire length. These, as in the case with the taenidia of the tracheae, may be pulled off in spiral rings. At the lateral margins, where the longitudinal furrows occur, these rings bend inward and appear to be less highly developed. The whole structure, however, is so strong that it tends to hold these parts of the gland open at all times. This rigidity is evidently due to the corrugations, and not to any particular thickenings, for in cross-section no such thickenings are seen (fig. 16). Close examination of the intima here reveals many fine canals (canaliculi) extending through it which evidently are outlets for fluids secreted by the overlying cells.

The intima of the sack is not reinforced by ring-like corrugations, but is flabby, and collapses when the secretion is drained out. It has, however, a very irregular surface, the inequalities having a wavy appearance. Besides the small inequalities, a still closer examination of the intima shows the surface to be covered with what appear to be very many closely-placed, minute pits. These, too, are probably pores for the liberation of secretions into the lumen. In cross section (fig. 17) or in a lateral view, which may be easily obtained, due to the irregularities of the surface, these pits show as small crinkles or even as fine chains.

The cells over-lying the bulb are distinctly yellow in color, relatively large, and polygonal in outline. In tangential section they show very large, many-branched, single nuclei (fig. 12). The whole content is granular, the granules of the cytoplasm being finer than those of the nucleus. In permanently prepared slides, a clear border is seen to surround the nuclei which may be an artifact. In a few measurements made, the average dimensions of the cells were 0.082 mm. long by 0.043 mm. wide. When the bulb is sectioned longitudinally so as to cut the corrugations cross-wise, it will be seen that the thickness of the wall is mainly due to these secretory cells (fig. 16). The heavier parts of the wall attain a depth of 0.06 mm., the corrugations dipping into the cellular tissue for about one-third of the depth. It will also be seen that the cells project up into the loops or corrugations of the intima. The canaliculi

mentioned before may be distinctly seen radiating through the intima surrounding these finger-like projections. In these sections there may be found cells appearing to have more than one nucleus. This, it will be understood, is due to the branched nuclei cut in more than one place.

In the small, ventral white lump at the apical end of the bulb, the cells appear long and club-shaped, and their contents rather coarsely granular. A closer study will likely show that they are spindle-shaped, in this way forming a wall of a bulb; no chitin, however, can be seen extending into this structure.

In the sack, the corresponding cells present most interesting features. From a surface view, they resemble very small white stars[10], or cog-wheels, the cogs interlocking. This is particularly evident when the tissue is stretched so as to separate them somewhat. Thinking of them in three dimensions, one may regard them as irregular, cup-like forms embedded in the intima, and resting with the larger base on the basement membrane,—the cup being irregularly perforated along its longitudinal diameter. The difference in size between the two ends of the cup may be experimentally determined by removing the intima and focusing down on the cells as they rest against the basement membrane. The cogs, so to speak, will then be seen to become longer and longer as their distal ends come into view. In this way the diameter of a number of cells has been found to have an average increase of about 0.012 mm. These cells are shown in outline in fig. 13, and, as the intima was removed, the clear spaces between them and through them will give an idea of the pattern found on the intima which was referred to above as being wavy. By staining with Mayer's haematoxylin the cell structure was found to be a mass of very fine reticulations, and between the meshes small vacuoles were frequently observed (fig. 14). The nuclei are also many branched, the branches extending into the cogs of the cells. As a matter of fact the nuclei appear to consist largely of heavier reticulations which thus stain heavily. In cross-section it will be seen that these reticulations sometimes take an arborescent form. The apparently continuous nuclear structure in cross-section is due to interlocking cells having been sectioned together. Here, too, it will be seen that the wall of the sack is largely composed of cell tissue, the intima being thin and folding down into the cells.

The thickness of the gland-wall here is approximately 0.04 mm., and as the stellate cells project up into the undulations, this is at the same time practically the depth of the cell. In a number of measurements made the longitudinal diameter of these cells averaged 0.09 mm.

Incidentally the tracheal supply to a few individual stellate cells was also noticed (fig. 15). As each cell is evidently isolated by the intima passing around and through it, it must have its separate oxygen supply. From the diagram it appears that a few tracheae may go to the same cell. The problem of cell aeration, however, has not been studied.

The histology of the connecting tube favors that of the bulb, while that of the false duct is similar to that of the body-wall.

From this discussion it will be seen that both parts of the gland are evidently secretory in function. It is possible that most of the flushing mater-

10—On this account I have called them stellate cells.

ial is secreted by the sack, and the stronger and more irritating ingredients by the bulb. The very large nuclei would tend to indicate a high metabolism in proportion to the volume of cell tissue.

Composition of the Secretion.

Through the kindness of Professor Chamot of the Department of Chemistry at Cornell an attempt was made to determine the composition of the gland contents. By the use of chloroform it was not very difficult to anaesthetize a number of caterpillars without disturbing them sufficiently to cause ejection of the secretion. The glands were then removed in toto, the sacks opened and the contents allowed to drain out. This liquid was then fractionally distilled in a microchemical distilling bulb.

A white crystaline solid condensed on the receiver immersed in a freezing mixture. This was tested for formic acid by the usual methods, viz: the formation of lead, silver and copper formate crystals. These were found to be morphologically the same as those obtained from pure formic acid and also to behave similarly under the polarizing microscope. In the liquid state this condensate is very acrid and volatile, has the odour of formic acid with the characteristic behaviour in a wet test. There were some indications of traces of acetic acid but these were so unsatisfactory that its presence is doubted. If it is present, it is in traces only. In addition there is reason to believe that a very small amount of a more volatile, acrid and irritating substance than formic acid is present, but its nature has not yet been ascertained. This substance appears in the first fractions, is exceedingly irritating and attacks the mucous membrane of the eyes, nose and mouth.

There remains in the bulb of the distilling tube a non-volatile residue, more or less viscous, in which certain components are precipitated as a flocculent deposit by heat. No examination has been made of these non-volatile components.

It might be mentioned that if a further analytical study of the secretion is carried out an attempt will be made to isolate the contents of the bulb and the sack, for as seen by the histological study, these parts have very different secretory cells.

Mechanism.

As there are no muscles connected with the gland proper except at the apex of the bulb, it is quite evident that the force necessary to cause the protrusion of the apex and the ejection of the fluid must be derived from outlying muscles. These have not been studied but no doubt the protrusion is brought about by a general thoracic pressure, while the ejection is caused by a particular dorso-ventral pressure on the bulb. That this particular force must come into play is quite evident from the structure of this part, for the lateral furrows with their incurved corrugations act like springs and the whole organ works like a bellows. This may be easily demonstrated after the bulb has been dissected out, for on pressing the dorsal and ventral halves together they spring back when this pressure is relieved. It might be argued that the whole gland is under pressure and that this forces the liquid out. It probably is all under pressure, but it is not reasonable to believe that so flaccid a receptacle as the sack lying in so large and irregular a space, could be responsible for the short,

quick squirts. Besides the caterpillar may eject a number of sprays in succession; hence there likely are small, more or less definitely proportioned, quantities sent out such as the bulb might hold. It might also be argued that the pressure on the bulb would force the liquid back into the sack. The backward flow is evidently prevented by the lateral furrows being sufficiently wide to allow enough appression of the dorsal and ventral halves of the bulb and connecting tube to bring the internal margin of the two halves together (fig. 19), cutting off the backward escape. In this will be seen the necessity of the extension of the furrows through the connecting tube (fig. 7). This pressure on the bulb may be partly effected when the caterpillar throws its head back at the time it ejects the fluid. It is possible that the quantity of liquid ejected may be secondarily controlled by the action of the valves at the end of the bulb and at the end of the false duct. However, since the apex projects out through and beyond the body-wall when the gland is in action it is not likely that the lateral muscles described as arising here, function in closing this valve, for they would then tend to draw the apex back into the body. The opening in the body-wall may, however, function in shutting off the spray. When the apex is protruded, the slit-like opening assumes the shape of a square, and, as relatively powerful muscles radiate from the lateral ends when in a normal position, these may in the distended form, act as strong lateral extensors tending to pinch the walls of the apex together. In addition the small median lump, referred to above, may be pushed like a plug into the lumen, assisting the cutoff. It might be argued that this lump would normally tend to close the lumen even when these lateral muscles were not particularly tightened. To overcome this action a median muscle extending from the posterior lip of the opening to the ventral body-wall would become necessary. No such muscle was noticed in the dissections but in looking over sections of this part of the body a muscle has been found (figs.[11] 19 and 20, p. dil. mus.) which may possibly function as such, although it is evidently not attached to the lip. By contraction of this muscle, granted that the above conjectured function is correct, the lumen of the apex would at once be opened, due to the release of pressure both on the plug and on the elastic, chitinized wall of the apex. By the action of this muscle, too, the lateral muscles from the external opening could be used in helping to direct the apex from side to side, without cutting off the escape of the liquid.

The function of the other paired muscles can be quite readily deduced when the conditions after extrusion of the apex are considered. The lateral muscles no doubt assist in drawing the apex from side to side. Those passing from the apex to the dorsal margin of the head naturally function as retractors of the apex. As the apex must also be drawn backward by a horizontal force, the two "elbowed muscles" would naturally come into play and thus the combined upward and backward forces would result in the passage of the bulb diagonally back into its normal position.

The finger-like projections mentioned as arising from the anterior extremity of the protuded apex may possibly aid in the backward direction of the spray. This function is, however, merely a supposition.

11—As the longitudinal axis of the bulb was not in perfect alignment with the knife, three of the series of the sections have been included for the sake of clearness.

Function of the Gland.

There may be two functions, the one defensive and the other protective. As to the former there can be little doubt, for it is not likely that a sparrow or any other small predaceous enemy would repeat an attack on the caterpillar after receiving a quantity of the highly irritating secretion in its eyes or mouth. Besides, if the gland were not defensive, it is not probable that the caterpillar would have acquired such dexterity in its repugnatorial use. It might be mentioned, however, that the defence against parasite enemies is inadequate, judging from the high degree to which the larvae are parasitised. The problem of the possible second function has not been well worked out. If it obtains, it is very important, for then it forms a necessary factor in the life of the species. It will be recalled that this species hibernates as a caterpillar, descending from the trees in the late summer and in the fall and spinning a cocoon near the surface of the ground. It is thus considerably exposed to rains, frost, and all the rigors of the seasons following. This exposure presupposes a well developed means of protection and one would naturally look to the cocoons for it. If one of them be examined it will be found to be parchment-like, simulating a piece of clear mica. It evidently becomes waterproof, in fact, one has been observed to hold a liquid for a longtime. The question of the second function then has to do with the making of the cocoon and an investigation of the problem was suggested by work done in Europe by Poulton and Latter on *Dicranura vinula*. Poulton (1886) found that a freshly made cocoon, while still damp gave an acidic reaction while Latter (1897) showed that the formic acid secreted by the larva was utilized, not only for defensive purposes during larval life, but also for giving a special character to the silk of the cocoon, whereby it became extremely tenacious to any foreign substance brought in contact with it and also extraordinarily hard, waterproof and completely closed against all aggressors. It is doubtful if this takes place in the species under consideration. On examining a piece of the cocoon under the polarizing microscope there was found what appeared to be strands of silk having much the same relative position and shape as would be expected from the way in which a cocoon is spun. When examined with a dark-field illuminator, a somewhat similar pattern was observed. This evidence, then, would lead to the belief that if there is a secondary substance employed in making the walls of the cocoon homogeneous it must act as a kind of gum or varnish, so to speak, to fill in the interstices. If this is the case, then the index of refraction of the gum is so nearly that of the strands as to practically cause both to disappear together. If the acid has a solvent effect, as Latter seems to show, both it and the silk would have to be sent out at the same time[12], for it is not at all likely that the caterpillar can secrete any fluid strong enough to act chemically on the once exposed silk. In watching a caterpillar spin on a glass plate nothing extraordinary seemed to occur in the matter of spinning, but there was some coalescence of the fibres where they came into contact. Possibly if the spinning had been continued until the meshes had become sufficiently small total coalescence would have taken place, pro-

12—Note in figure 10 and 11 how conveniently the extruded apex is situated with regard to the spinneret.

ducing a homogeneous wall. However, microscopic examination of the glass does not show peculiar local running or spreading of the silk.

Working on the supposition that there is an interstital gum present, it might be added that attempts to mount the parchment in a medium of such a refractive index as to eliminate the gum were not wholly successful, and further, that no attempts were made to dissolve out the gum.

Summary.

In conclusion it is evident that this structure must be included in the category of defensive glands among insects. More particularly, it belongs to a group of glands discussed by Berlese under the heading, "*Ventral of the Prothorax or Jugular Ventral.*" For the want of a more specific name the former designation has been retained for the gland under discussion,—a name not inappropriate since the structure possibly arose from simple ventral thoracic invaginations in which the prothoracic one has been rather generally retained in the Lepidoptera[13]. This ventral prothoracic gland, in fact, occurs as a rather simple structure in *Hyponomeuta malinella*, an isolated and primitive genus of the Tineids (Berlese 1909). In the study of the morphology, histology and mechanism of this gland one must conclude that it is a very highly developed and specialized structure. Its efficiency in defence seems to be anticipated in the development of the larva, for the mature caterpillar assumes very marked warning attributes with its red head and prominent, red, spiny hump. In this highly developed and efficient form one might be influenced to believe that the complex gland phylogenetically antedates the simple ones, but when one recalls the irregularities of its position with respect to the other organs of the thorax, the peculiar tracheation and the seeming obtrusiveness of its position, one must conclude that the evidence rather supports the contrary view. As to its possessing a protective fluid little can as yet be said beyond the fact that the nature of the cocoon tends to support the view.

ACKNOWLEDGMENTS

Special acknowledgments are due Dr. E. M. Chamot, Professor of Chemical Microscopy and Sanitary Chemistry at Cornell, who not only made chemical analyses of the secretion, but also rendered valuable further assistance by his interest in the problem as a whole. The writer also wishes to express his gratitude for helpful suggestions given by members of the Entomological staff.

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13—For a general discussion of these glands see Dimmock (1882), Packard (1890) and Latter (1887). These authors also give references to literature while Packard (1896) devotes a paper entirely to literature on eversible glands. A very excellent study of the secretion of *C. vinula* is given by Poulton (1887), the gland having been well described by Klemensiewicz (1882). See also Berlese (1909).

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ABBREVIATIONS

a, b, c, d, e, f, g, h, i. .... see text under "Musculature"
ab. gng. 1, ... first abdominal ganglior
ap., ... apex
br., ... brain
bu., ... bulb of gland
b. mem., ... basement membrane
can., ... canaliculi
chi. pt., ... chitinized point
chi. ar., ... chitinized area
con., ... connective
con. tu., ... connecting tube
cru. cer., ... cruri cerebri
cyt., ... cytoplasm
d. bu. tr., ... trachea to dorsum of bulb
d. sa. tr., ... trachea to dorsum of sack
ey., ... eyes
elb. mus., ... elbowed muscle
f. int., ... fore-intestine
fal. du, ... false duct
hd., ... head
inta., ... intima
l. ant. thr. sp. ..... left anterior thoracic spiracle (region of)

lat. fr., ... lateral furrow
m. int., ... mid-intestine
m. int. tr., ... mid-intestinal trachea
n. ..... nucleus
ner. syst., ... nervous system
p. dil. mus., ... posterior dilator muscle
r. ant. thr. sp., ... right anterior thoracic spiracle (region of except in figure 10)
sa., ... sack of gland
s. du., ... silk duct
s. gl., ... silk gland
stl. cl., ... stellate cell
s-ap. lmp., ... sub-apical lump
s-oe. gng., ... suboesophageal ganglion
spin., ... spinneret
thr. gng. 1, ... prothoracic ganglion
thr. gng. 2, ... mesothoracic ganglion
thr. gng. 3, ... metathoracic ganglion
tr., ... trachea
v. but. tr., ... trachea to venter of bulb
v. sa. tr., ... trachea to venter of sack
vac., ... vacuole

Explanation of Plates.

Plate 3.

Fig. 1. Final stage caterpillar of *S. concinna* in a natural feeding posture; internal organs somewhat diagrammatically illustrated; actual length about 1.25 in.

Fig. 2. Dissection of organs in anterior part of body, dorsal aspect.

Fig. 3. Dissection of organs in anterior part of body, dorsal aspect; oesophagus turned to left and other organs in normal position.

Fig. 4. Dorsal aspect of suboesophageal, and prothoracic ganglia, and postero-lateral view of bulb and connecting tube.

Fig. 5. Sack turned on its right side.

Fig. 6. Musculature, dorsal aspect, including corrugated apical end of bulb; anterior part showing muscles "a", "b" and "c" somewhat diagrammatically illustrated.

Fig. 7. Lateral aspect of bulb and connecting tube showing only corrugated lining (intima).

Fig. 8. Latero-ventral aspect of bulb, connecting tube, lower part of sack and sub-apical lump (gland thrown forward).

Plate 4.

Fig. 9. Normal position of gland figured in number 8.

Fig. 10. Ventral view of anterior part of caterpillar.

Fig. 11. Lateral view of anterior part of caterpillar.

Fig. 12. Tangential section of bulb wall showing the over-lying secretory cells.

Fig. 13. Stellate cells, the intima removed, and the cells standing on the basement membrane when drawn.

Fig. 14. Tangential section of sack wall showing stellate cell.

Fig. 15. Tracheal supply to stellate cells.

Fig. 16. Cross-section cells and corrugated intima of bulb.

Fig. 17. Cross-section cells and undulated intima of sack.

Figs. 18, 19, and 20. Saggital sections of the bulb in the regions of the connecting tube and false duct.

NOTES AND CORRECTIONS. (SYRPHIDAE, DIPTERA)

BY C. HOWARD CURRAN,

Orillia, Ontario.

For *Chilosia rita* new species, Can. Ent., Vol. LIV, page 70, read *Chilosia ontario* new species.

For *Chilosia columbiae* new species, l. c., page 69, read *Chilosia robusta* Hine.

Prof. Hine's description of what is undoubtedly the same species was published in the March number of the Ohio Journal of Science, page 144, based on specimens from Alaska. I did not become aware of the description of this species until too late to change the name. I have also seen specimens from Washington State. The species is very close to *aldrichi* Hunter.

Chilosia orilliaensis occurs also in New Brunswick and I have six specimens from the vicinity of Fredericton.

Syrphus rectoides Curran may be very readily distinguished from *S. genualis* Williston by the fact that the latter has complete transverse black fasciae on the venter in both sexes, while the former has a median row of fuscous spots in the female and in the male these spots are more like those of *S. ribesii* L. The female of the former may be distinguished from the female of *S. insolitus* Osburn by the narrower facial stripe which stops well before the antennae.

Melanostoma chilosia Curran: A female specimen from Mount Ranier, Washington, collected by Prof. A. L. Melander agrees almost perfectly with the type from Banff, Alberta, but the pile appears to be slightly longer. This species is close to *M. (Chilosia) parva* Williston, but the facial tubercle is more prominent and the legs are chiefly black, whereas in *parva* the legs are almost all reddish, except the bases of the femora.

Melanostoma lata; vol. LIII, p. 276, second paragraph, line 11, for "a broad crossband on the posterior half"; read "..... on the anterior half."

CHANGE OF NAMES IN CICINDELA.

Dr. Walter Horn of Berlin informs me that two of the names recently proposed in the March number of this journal, viz: *azurea* and *elegans,* are preoccupied. This necessitates a renaming as follows:—

C. azurea is changed to *C. wallisi.*

C. elegans is changed to *C. westbourneí.* E. E. Calder.

A NEW FORM OF SATURNIID FROM MISSISSIPPI AND FLORIDA (LEPIDOPTERA)

BY F. H. BENJAMIN,
Agricultural College, Mississippi.

Tropaea luna race **dictynna**, spring form **mariae**, form nov.

The exact status of *dictynna* being questionable the author prefers to temporarily consider it the Gulf Strip race of *T. luna*. It is, however, to be born in mind that the wing shape is entirely different from *luna*, and that the cocoon is much larger. It is entirely possible that *T. dictynna* may be a valid species. The so-called northern examples of *dictynna* seen by the author while possessing the stripe on the wings, always found in true *dictynna* to the best of his knowledge, have a wing shape similar to true *luna*.

The spring form of *dictynna*, herein described, occupies the same relative position in relation to the normal form that *rubromarginata* Davis occupies in relation to true *luna*. The wing shape of *mariae* is similar to *dictynna*, but the tails are longer, in this respect approaching *luna*. The dark stripes of *dictynna* are present across both pair of wings. Outer borders a beautiful deep reddish-lavender, with violaceous-blue bordering this internally. In this respect similar to *rubromarginata*. Abdomen pure white with a lateral violaceous stripe. Sexes similar.

Type Locality and Number and Sexes of Types: Holotype ♀, Ocean Springs, Mississippi, March 20th, (Collector, R. P. Barnhart, Inspector, State Plant Board); Allotype ♂, Agricultural College, Mississippi, May 1st (G. F. Arnold, Assistant Entomologist in Charge of Quarantine Department, State Plant Board); Paratype ♂, March 9th, Agricultural College, Mississippi (from student collections); Paratype ♀, St. Petersburg, Florida, April 21st (collection of Dr. William Barnes).

Types. Holotype ♀, deposited as loan material in the collection of Dr. William Barnes; Allotype ♂ and Paratype ♂, collection of Agricultural College, Mississippi; Paratype ♀ (St. Petersburg specimen), collection of Dr. William Barnes.

Named by the author in respect to his wife, in remembrance of the many inconveniences suffered without complaint in frequent collecting trips in Mississippi.

ANNUAL MEETING.

The Entomological Society of Ontario.

The Annual Meeting of the Entomological Society of Ontario will be held at the Ontario Agricultural College, Guelph, on Friday and Saturday, November the 24th and 25th. Members are requested to send at once, to the secretary, the titles of papers which they will present at the meeting, stating the time required for each. A successful meeting is expected and all members are urged to make a special effort to be present.

A. W. Baker, O. A. College, Guelph, Ont. Secretary

F. J. A. Morris, Peterborough, Ont. President.

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POPULAR AND PRACTICAL ENTOMOLOGY

The Evening Primrose in Relation to Insects*

BY HARRY B. WEISS,

New Brunswick, N. J.

There is a mutual interdependence of insects and plants in which both may be benefited, or if one is injured, the resulting benefit is so great in comparison with the injury that it does not impair the value of the relation. There is also a dependence in which the insect alone benefits and the plant suffers all the injury. Many insects depend entirely upon plants for their very existence and contribute nothing in return. The plant tissue furnishes them food and possibly shelter. However, the amount and character of the injury may vary considerably and be either a serious check to growth or a negligible happening in the life of the plant.

The number of insect species supported by one kind of plant is often very large. Folsom[1] states that the horse-chestnut and buckeye have perhaps a dozen species, the elm eighty, the birches over one hundred, the pines over one hundred and seventy, while the oaks sustain certainly five hundred and probably twice as many more. The clover is affected by about two hundred species directly or indirectly, but grows vigorously and is able to withstand considerable injury. Corn harbors about two hundred species, fifty of which do serious injury, and apple supports some four hundred species. Some plants are almost free from attack, such as poison ivy, which is supposed to support only four species.

In this paper, the term "evening primrose" should be taken to mean those species commonly and incorrectly known as *Oenothera biennis*. The true *O. biennis* has not been found in America but is widely distributed in Europe. The Oenotheras are of American origin, but *biennis* has no known native American habitat as yet. They are usually dry soil plants, mostly biennial, making only a rosette during the first year. The following observations are the results of a year's study of primrose insects, mostly in New Jersey supplemented by the results of students in other parts of the United States.

The number of species of insects (excluding parasites) found to be associated either directly or indirectly with the evening primrose was over one hundred, a small number in comparison with the numbers affecting oaks but large in comparison with the numbers associated with many other plants and weeds. From the time the primrose appears above the ground until its death, it is more or less continuously infested, and even its dead dry stalks furnish shelter for some species. Beginning with the rosette stage, the leaves forming the head

*A complete account of the various insects associated with evening primrose appeared in the Journal of the New York Entomological Society, under the title, The Insects of the Evening Primroses in New Jersey by E. L. Dickerson and H. B. Weiss, vol. 28. No. 1, 1920.

1—Entomology with reference to its Biological and Economic Aspects, 1906.

serve as food for the larvae of a small, gaily colored moth *Phalonia oenotherana* Riley and hibernation quarters for the weevil *Tyloderma aerea* Say and undoubtedly other species of Coleoptera.

During the second year of its growth and in late spring when it is scarcely a foot high, the leaves are quite likely to harbor numerous plant lice. As it continues to grow, such beetles as *Haltica marevagans* Horn, *Haltica fuscoaenea* Mels., *Graphops pubescens* Mels., *Anomala lucicola, Epitrix cucumeris, Phyllotreta sinuata, Gymnetron teter* are found feeding on the foliage. Sometimes it is completely riddled by the first two species and their larvae which are flea beetles. The tip moth *Phalonia oenotherana* also reappears and infests the growing tip of the stalk. The stalk is further infested all summer by large numbers of *Tyloderma fovcolata* larvae which are found for the most part in the lower portion while the entire remainder even to the extreme tip is very often channeled by the numerous larvae of another small moth known as *Mompha cloisella* Clem. In addition to the Coleoptera or beetle feeders noted above, the foliage is quite likely to support in addition, the larvae of the following Lepidoptera, *Desmia funeralis* Hubn., commonly known as a pest of grape; *Celerio lineata* Fabr., the White Lined Sphinx, which has a large list of food plants, *Apantesis arge* Dru., a corn feeder, *Euthisanotia unio* Hubn., *Eupithecia interruptofasciata* Pack., and *Sparganothis sulfureana* Clem.

When the flower buds appear they are eaten by the Lepidopterous larva of *Rhodophora florida*, this species boring a round hole in the bud of sufficient size to admit its head, which it sinks downward, feeding as it goes, on the folded floral parts. Two other Lepidopterous larvae, those of *Mompha stellella* Busck, and *Mompha murtfeldtella* Cham., feed within the bud on the immature floral parts, causing the bud to swell appreciably. In addition, the buds are likely to be infested by the larvae of the weevil *Acanthoscelis acephalus* Say.

When the seed capsules appear, their contents are usually partly eaten by such species as *Mompha circumscriptella* Zell, *and Mompha brevivittella* Clem., and late in the fall many are covered by plant lice. In a few cases, aphids are found on the roots. In addition to the species enumerated above, many other miscellaneous ones were found on the foliage and stem and in the blossoms. Some, such as lady-bird beetles and ants, were indirect associates being directly associated with the aphids. Others were possible feeders and accidental visitors. The following tables summarize the distribution and activities of primrose insects.

DISTRIBUTION OF PRIMROSE INSECT FEEDERS AND FLOWER VISITORS

	Number of species feeding on or in					Flower visitors.	Totals
	roots	stem	leaves	flower buds	seed capsules		
Homoptera	1		8				9
Hemiptera			1				1
Coleoptera		1	11	1			13
Lepidoptera		1	7	3	2	1	14
Hymenoptera			1			10	11
Diptera			1			1	2
Totals	1	2	29	4	2	12	50

ACTIVITIES OF ALL PRIMROSE INSECTS

	Known Feeders on or in during one or more stages.	Flower visitors	Found on foliage or stems. Some are probably feeders.	Totals
Homoptera	9		4	13
Hemiptera	1		15	16
Coleoptera	13		32	45
Lepidoptera	13	1		14
Hymenoptera*	1	10	9	20
Diptera*	1	1	2	4
Totals	38	12	62	112

*Parasites not included

Thus of a total of 111 species, 38 or over one third utilize the plants for food purposes, many of them being present at the same time and others succeeding each other throughout the growing season. Yet in spite of almost constant and in many cases severe infestations, the growth of the plant is hardly ever visibly impaired and the insect visitations appear to be negligible happenings in the life of the plant. In spite of the injury to the rosette, the main stalk shoots up the following season. In spite of being tunneled from base to tip, it produces branches and leaves which are in turn riddled by leaf feeders. Flowers are produced profusely in spite of the bud injury and while many seed capsules are damaged, plenty escape. Hundreds of plants infested in all degrees were examined and aside from a small amount of fasciation, a small amount of distortion and a slight stunting which may have been due to other causes, no apparent or serious setback in the growth was observed. Infested plants developed, flowered, produced seed and died more or less the same as uninfested plants. Under such conditions, the results to many plants other than primrose would probably be more or less fatal, but the primroses are evidently vigorous enough to outgrow the injuries of a host of insects.

NOTES ON NEW JERSEY HETEROCERA WITH DESCRIPTIONS OF ONE NEW SPECIES AND TWO NEW FORMS.

BY F. H. BENJAMIN,

Agricultural College, Mississippi.

During the summer of 1919 the writer spent almost every week end in the New Jersey Pine Barrens, mainly at Brown's Mills in the Pines. Besides many rarities, the following new forms and one new species were taken. The types of these were very carefully compared at the collection of Dr. William Barnes by the author, and in order to eliminate any chance of error, checked by Dr. A. W. Lindsey.

Eriopyga (Orthodes) lindseyi n. sp.

Head, thorax and ground color of the fore-wings concolorously reddish, with a tendency toward ochreous and with a strong satiny luster. Antennae simple, ciliated, cilia in block like pattern on basal segments, longer setae visible on apical segments. Prothorax with a small, spreading somewhat divided crest; metathorax with a very small divided crest, or at least a trace of one pro-

duced by hair tuftings. A few blackish scales tend to form a black line at the base of the prothoracic crest, and another on collar. Fore-wings with all lines double, and filled in with less reddish and more ochreous color than the ground, as are the reinforms and orbiculars. Subbasal line waved; transverse anterior waved; rather indistinct; orbicular small, round; reniform kidney shaped; two small white spots, one on each side of the reniform at its base, tending to become semi-confluent by the presence of a few white scales between them; transverse posterior line strongly outcurved from costa to vein 4, then incurved toward inner margin, slightly drawn out on the inner margin, thus forming a complete S; a suggestion of minute ochreous spots on some of the veins in the subterminal space, subterminal line oblique inwardly at costa, outwardly so in radial region, inwardly again in medial area, thus forming a rough reversed Z, below which it is evenly outcurved, finally projected to the inner margin as another outcurved scollop, a terminal row of minute black dots between the veins, which of themselves possess a scattering of black scales, fringe concolorous with the ground. Secondaries whitish with considerable fuscous shading; the terminal border marked by a thin, blackish line composed of elongated dots, fringe light at base and tips, a broad, dusky line through center; discoidal spot visible, probably mainly showing through from under side; veins somewhat dusky. Beneath: both wings whitish-fuscous, with discoidal spot and common line darker, dusky; a row of terminal spots between the veins on both wings; cell of fore-wing sparsely clothed with long hair. Sexes identical.

Type Locality: Brown's Mills in the Pines and 1 ♂ Overbrook, N. J.; also 2 ♂, 1 ♀, Barnes Coll., Pitman, N. J.

No. and Sexes of Types: Holotype ♂, Allotype ♀, 29 Paratypes ♂ ♀.

Dates of Capture: V, VII, IX.

Types in: Collection of Author, and Barnes; also 1 Paratype, U. S. N. M.

This insect to some extent resembles *vecors, irrorata, pucrilis* and when badly rubbed—*furfurata*, but seems abundantly distinct. The vestiture is far more scaly than is typical for members of the group *Orthodes*, and the satiny luster to the wings more pronounced. The vestiture is so scaly that the insect might well be placed in the genus *Mamestra* (*Polia*) were it not for its general appearance, resemblance, and apparent close relationship in all other characters to described members of the group *Orthodes*.

Chytonix sensilis form **macdonaldi** form nov.

Sir George Hampson places *Chytonix sensilis* in that group of the genus *Chytonix* having simple antennae in the male sex. However, the Cat. Lep. Phal., B. M., seems to indicate that he did not know the male, which is similar to the female in pattern and maculation, but the antennae are laminate, the laminations almost forming short pectinations. Two males of the typical form were taken; and also one female without the white spot below the black streak connecting the transverse anterior and the transverse posterior lines in the submedian fold. This corresponds to ab. l. of Hampson. One male and two females lacked the black streak, and in these the white spot is completely diffused by mixing with a suffusion of whitish scaling in the medial area. The resulting insect scarcely resembles the typical form, and may henceforth be known

under the form name *macdonaldi*, in remembrance of the many nights in the Pine Barrens during which Neil F. MacDonald, B. Chem., assisted untiringly the work of the author.

The general condition of all the specimens of this form taken is none the best. The females are in better condition than the male, and hence one of these is designated the holotype. This specimen has the transverse anterior and transverse posterior lines spaced a little further apart on the inner margin than is typical of *C. sensilis*. The male allotype and female paratype are normal in this respect.

Type Locality: Brown's Mills in the Pines, N. J.

No. and sexes of Types: Holotype ♀, Allotype ♂, 1 Paratype ♀.

Types in: Collection of Author.

Olene atomaria form **aridensis** form nov.

Size, lines and ordinary spots similar to *O. atomaria*. Female: fore-wing; basal area filled in with chocolate-brown to the transverse anterior line; subterminal area similarly filled; the medial area pale, olivaceous, with tendencies to blueish in some specimens and greenish in others, more suffused with color basally and inwardly. This gives a general impression of *O cinnamomea*, but the size is larger and it matches in no other details. The reniform spot is strongly outlined with a fine chocolate-brown line, and is filled in paler than the pale medial area. As usual with species of this genus the basal edge of this spot is strongly marked. Hind wings an even medium brown with only the discal spot showing in some specimens, while in others a trace of a shade line is to be found. In this respect as well as in the peculiar coloration of the fore-wings, the form differs considerably from typical *O. atomaria*. Under side with discoidal spot, and shade line half way between spot and outer margin. Male: fore-wing with the basal area strongly tinged with purple; the subterminal area lighter brown than in the female, with a purplish and white patch on anal region; otherwise similar to the female, except that there is a waved line of the same color as the medial area through the basal brown area, thus cutting this into two parts. On the underside, the spots and lines are similar to the same ones in the female, but somewhat more suffused and broader, with the line on the fore-wing somewhat nearer to the spot.

This form is described mainly at the suggestion of Dr. William Barnes. At Brown's Mills in the Pines, N. J., *atomaria* runs to two forms; one much lighter than typical, more suffused, and with much less brown on the fore-wings. Of this form I have two specimens: ♂ ♀, the ♂ taken 31-VIII-19, the ♀ 5-VIII-19. The other form is described above.

Type Locality: Brown's Mills in the Pines, N. J.

No. and sexes of Types: Holotype ♀, Allotype ♂, Paratypes 11 ♀ ♀, also 1 egg from Holotype.

Dates of Capture: August.

Types in: Collection of Author; 2 Paratypes and egg, Collection of Cornell University, 2 Paratypes, Collection Wm. Barnes.

NOTES ON FUNGOUS INSECTS.

BY HARRY B. WEISS and ERDMAN WEST,

New Brunswick, N. J.

The following notes on fungous insects have accumulated since the publication of former papers along this line.* Records not specifically credited were obtained by the writers.

In Entomological News Vol. XXX, No. 5, pp. 144—5, Mr. W. H. Wellhouse calls attention to *Mycodiplosis cerasifolia* (Dip.) feeding on the spores of Crataegus rust (*Gymnosporangium clavipes* C. and P.). Mr. Wellhouse found the larvae of this itonid living among the aeciospores and feeding upon them. Gravatt and Posey (Jour. Agric. Res. vol. 12, No. 7) state that "larvae of the gipsy moth (*Porthetria dispar*) feed on the peridermium stage of *Cronartium ribicola* and carry thousands of aeciospores on their bodies." They further state that the larvae feed abundantly on the spores and injure the fruiting layer of the postules so that further spore production is arrested.

In a letter Mr. Thos. E. Snyder informs us that the beetle *Cupes concolor* is usually found in the southeastern states in oak stumps upon which are growing the fruiting bodies of *Daedalia quercina*; the larvae of this beetle boring in the wood which has been penetrated by the mycelium of this fungus. Meyrick in his "Handbook of British Lepidoptera," mentions some seventeen species of *Tineidae*, the larvae of most of them being recorded as feeding on lichens.

Perris in "Larves de coléoptères," Paris, 1877 (Ann. Soc. Linn. XXII, XXIII) mentions *Tetratoma baudueri* in *Agaricus ostreatus* (p. 154), *Bolitophagus armatus* in *Boletus suberosus* (p. 116-7) and *Cis* living on branches infested by *Telephora* sp., (p. 65.) Ganglbauer in "Die Kafer von Mittel Europa, III" records *Liodes cinnamomea* in truffles (p. 209), *Agathidium seminulum* in *Trichia cinnaberina* (p. 241), *Diphyllus lunatus* Fab. in *Sphaeria concentrica* (p. 654), *Cryptophagus lycoperdi* in puffballs (p. 675), *Lathridius rugosus* on slime mould (myxomycetes) (p. 786), *Triphyllus bicolor* Fab. in *Fistulina hepatica* (p. 825) and *Lycoperdinen* on *Lycoperdon* and *Bovista* species (p. 912.)

The following records relate to species in this country which have been found to be associated more or less with polypores and gill fungi.

SLUGS

Limax maximus L. Sometimes eats ragged holes in caps of cultivated mushrooms. (Popenoe, U. S. D. A. Farmers' Bull. 789.)

SOWBUGS

Armadillidium vulgare Lat. Greenhouse pillbug. Sometimes feeds on caps of cultivated mushrooms (Popenoe, loc. cit.)

Porcellio laevis Koch. Dooryard sowbug. Sometimes feeds on caps of cultivated mushrooms. (Popenoe, loc. cit.)

ORTHOPTERA

Ceuthophilus pacificus Thom. Reported as eating into caps of cultivated mushrooms on Pacific Coast. (Popenoe, loc. cit.)

*Proc. Biol. Soc. Wash., vol. 33, pp. 1-20; vol. 34, pp. 59-62; vol. 34, pp. 85-88; vol. 34, pp. 167-72.

DIPTERA

Family *Phoridae*

Aphiochaeta albidihalteris Felt. Injurious to cultivated mushrooms. (Popenoe)
Sciara multiseta Felt. Injurious to cultivated mushrooms. (Popenoe)
Sciara agraria Felt. Injurious to cultivated mushrooms. (Popenoe)

COLEOPTERA

Family *Staphylinidae*

Philonthus cyanipennis Fab. Feeding on *Russula* sp. Lakehurst, N. J., June 30.
Tachinus fimbriatus Grav. Feeding on *Russula* sp. Lakehurst, N. J., June 30.
Boletobius cinctus Grav. Feeding on *Russula* and *Collybia* sp. Lakewood, N. J., June 30.

Family *Scaphidiidae*

Scaphisoma suturalis Lec. On *Clavaria* sp. Monmouth Jc., N. J., August 6.

Family *Nitidulidae*

Psilopyga nigripennis Lec. Occurs in the stink horn fungus. (Col. Ind. p. 646)
Psilopyga histrina Lec. Occurs in the stink horn fungus. (Col. Ind. p. 645)
Pocadius helvolus Erichs. Occurs in *Lycoperdon giganteum*. (Col. Ind. p. 644)
Carpophilus antiquus Mels. On the black fungus on ears of corn. Clementon, N. J., August 10. (Smith, Ins., N. J., p. 271)

Family *Erotylidae*

Tritoma bigattata Say. Feeding on *Russula* and *Collybia* sp. Lakehurst, N. J., June 30.

Family *Tenebrionidae*

Platydema ruficorne Sturm. Feeding on *Russula* and *Collybia* sp. Lakehurst, N. J., June 30.

Family *Anobiidae*

Dorcatoma setulosum Lec. Breeding in old *Polyporus cuticularis*. East Millstone, N. J., April 7.
Eutylistus tristriatus Lec. Breeding in old *Polyporus cuticularis*. East Millstone, N. J., April 7.

Family *Cisidae*

Plesiocis cribrum Csy. Breeding in *Polyporus volvatus* on pine stump. Lakehurst, N. J., June 30.

AN UNDESCRIBED PLANIDIUM OF PERILAMPUS FROM CONOCEPHALUS (HYM.)

BY NORMA FORD,

University of Toronto.

An interesting phase in the life history of parasitic Hymenoptera, of comparatively recent discovery, is the occurrence of the "planidium" stage of certain Chalcidoid genera, notably *Perilampus, Psilogaster* and *Orasema*. The life histories in which this stage appears are suggestive of the oil beetles (Meloidae) which hatch from the egg as free-living larvae, seek their host, and then become parasitic and helpless.

The first discovery in connection with this type of life history in the Chalcidoidea was made by Prof. Wheeler (1907). While engaged in studying the life history of *Orasema viridis* Ashmead, a parasite of the harvesting ant (*Pheidole instabilis* Emery), he found proof of an early free-living stage. This stage he termed the *planidium*, from the Greek meaning a diminutive wanderer. *Orasema* belongs to the Eucharidae, a family closely related to the Perilampidae. The Eucharidae are parasitic upon ants. The planidium in this case is less than 0.1 mm. in length. Prof. Wheeler found it difficult to determine the number of body segments, because of the telescoping, but he stated that there are probably thirteen. The head segment bears short mandibles and the terminal segment has a pair of caudal setae.

In 1912 H. S. Smith ('12) found the planidium of *Perilampus hyalinus* Say as a secondary parasite of the tachinid and ichneumonid parasites of the fall webworm. The planidium was less than 0.3 mm. in length, oblong in shape, and dark brown in color. It was highly organized with a distinct head, 12 body segments, well-defined mouth parts, strong curved mandibles. The head was armed with curved hooks; the most of the plates bore pairs of bristles and ventrally there were projecting spines, the latter evidently functioning in locomotion. There were no legs.

In tracing out the life history, Smith found the planidia in the earliest stages on the exterior of the fall webworm, later within their bodies whether they were infested by primary parasites or not. Still later the planidia were endoparasitic within the larvae of the parasites, and finally ectoparasitic after the larvae had left the fall webworms and pupated. How the planidia came to be located upon the skin of the caterpillars, and where the eggs are laid, have not been ascertained. It is thought that the eggs are laid on the leaves of plants in the vicinity of a caterpillar colony.

In the course of his investigations, Smith found a second species of planidium which he was unable to rear, and which he terms *Perilampus* "species A."

In 1915 Thompson described a planidium which was attached to the integument of a Noctuid, feeding on witch-hazel. This species of planidium is slightly larger, being 0.35 mm. by 0.13 mm. A most important difference is that this form has fourteen segments. The details of structure are also quite different, and as follows: The dorso-lateral plates which do not extend over the ventral surface, terminate abruptly. The setae arise dorsally from the intersegmental membrane, not from the plate, although there are unchitinized spots on the plates, which, however, do not give rise to setae. The ventral setae and spines show an arrangement quite different from *Perilampus*. In the head segment Thompson was able to follow in some detail the mouth parts, figuring and describing the epipharynx, superior and inferior lips, mandibles, maxillae and palpi. Dorsally on the head he identified a pair of antennae.

In 1919 Prof. Brues briefly described from a cast skin the planidium of *Psilogaster fasciiventris* Brues, a member of the Eucharidae and a parasite of the Australian Bull-dog Ant, *Myrmecia forficata* Fabr. Prof. Brues does not figure the planidium, but he states that it is similar to that of *Perilampus*. In fact he says that this stage of *Psilogaster* is almost as close to that of *Perilamp-*

us hyalinus as the latter is to *Perilampus* "species A," figured by Smith. Prof. Brues suggests that it may be possible that "species A" is not a true *Perilampus*, as Smith did not succeed in rearing an adult.

While investigating a problem on the musculature of the Orthoptera, as post-graduate work with Prof. E. M. Walker, specimens were found parasitized by planidia. In this case the planidia were within the bodies of one of the small green grasshoppers, *Conocephalus fasciatus* (De Geer) (*Xiphidium fasciatum*). The Conocephali had been collected on September 14, 1921, in the Muskoka district at Port Sydney, Ontario. Out of nine specimens, six were parasitized. The planidia from *Conocephalus* are very similar to those of *Perilampus hyalinus*, resembling this species more closely than the planidia of the unknown "species A," or of the Noctuid or of *Orasema*. A careful comparison with the figures of *Perilampus hyalinus*, however, reveals distinct difference from that species.

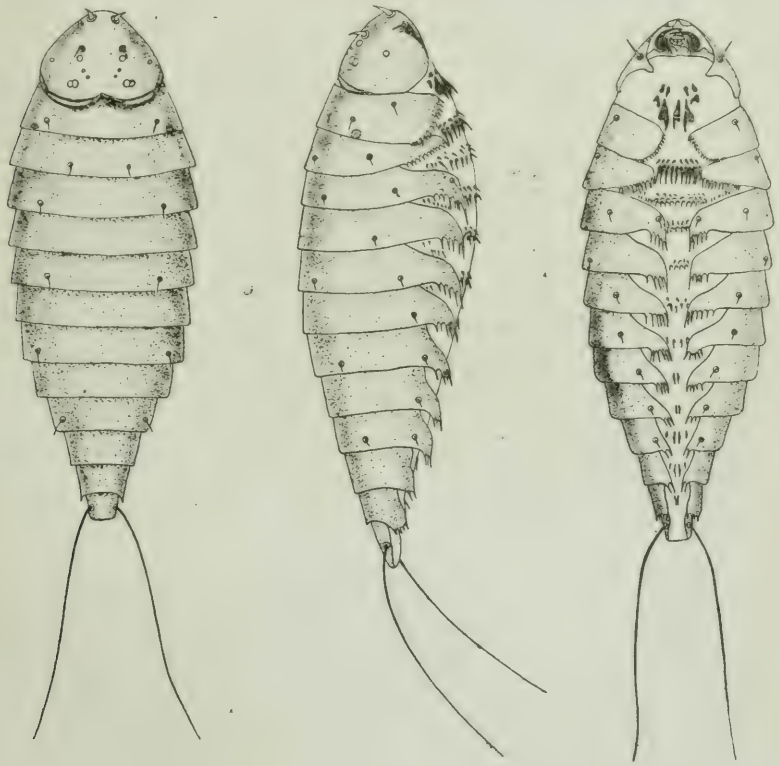

Fig. 1—Planidium of *Perilampus* from *Conocephalus*. From left to right, dorsal, lateral and ventral views.

The planidia from *Conocephalus* average 0.21 mm. in length, and 0.07 in diameter. Measurements of eight specimens were as follows: 0.23 x 0.07, 0.21 x 0.06, 0.19 x 0.08, 0.20 x 0.07, 0.20 x 0.06, 0.22 x 0.07, 0.21 x 0.07, 0.16 x 0.04 mm. The body is composed of thirteen segments, dark brown in color. The head segment is emarginate posteriorly and bears two pairs of recurved hooks. The posterior pair correspond to the structures which Thompson identified as an-

tennae, but in this species they are merely pointed hooks. Behind each hook of the posterior pair is a semi-transparent spot, followed by two smaller spots and then by a pair of large contiguous spots. There is also, on either side of the head, a lateral spot and a ventral-lateral hook.

The mouth-parts are difficult to determine. It would seem that the large curved mandibles are supported by a cross-bar of heavy chitin and that a distinct mouth-tube is present. Between the mouth-tube and the mandibles project forked structures which are probably maxillae.

Each body segment consists of a heavily chitinized tergite with a toothed ventral border and of an unchitinized sternal region provided with strong re-curved hooks. On the tergites are semitransparent spots each bearing a seta. These spots have a definite arangement in two rows—a dorsal and a ventral. The spots of the dorsal row are dorso-lateral in position and situated on the odd segments, 1, 3, 5, 7, and 9 and also on segment 2. The pair of spots on segment 2 are again exceptional because of their more dorsal position. The ventral row consists of spots ventro-lateral in position and situated on consecutive segments, 1, 2, 3, 4, 5, 6, 7, 8 and 9. An exception is found in segment 3 where the spots lie in a more ventral position and there is a third pair of spots situated on the extreme ventral portions of the tergite.

The two spiracles open dorso-laterally in the membrane connecting segments 1 and 2.

In the sternal region are groups of hooks segmentally arranged. The hooks of segment 1 are the largest and are arranged in two rows. Three hooks in the posterior row are much larger than the others, are attached by broad bases and taper into sharp re-curved points. Lateral and anterior to these are smaller hooks, varying in number in the anterior row from 3 to 5. In segment 2 the number varies from 8 to 9 in the anterior row and from 11 to 12 in the posterior row. In the remaining segments the number of hooks gradually decreases. The caudal setae are about six times the length of the last segment.

Comparing the planidium from *Conocephalus* with the planidium of *P. hyalinus*, the noteworthy points of difference are as follows: The planidium of *hyalinus* is larger and more slender, averaging 0.3 mm. in length and 0.06 mm. in diameter at the widest place, (as compared with 0.21 mm. in length and 0.07 mm. in diameter). The head segment lacks the lateral pair of semitransparent spots and ventro-lateral hooks. The dorsal row of spots on the tergites is similar in the two forms, but the spots of the ventral row on *P. hyalinus* extend only to segment 8, and in addition segment 8 bears a third pair of ventral spots, while on segment 3 the third pair is lacking. The spiracles are ventral in *hyalinus* instead of dorso-lateral, and the caudal setae are only twice the length of the last segment.

The planidium of "Species A" is quite different in structurural details from those just considered. The head segment is not emarginate, the ventral borders of the tergites are not toothed, the ambulatory spines are much less developed. The spots of the dorsal row on the tergites have a different arrangement being on segments 1, 2, 3, 4, 5, 6, 8 and 10, while those in the ventral row have an arrangement similar to that of the planidium from *Conocephalus*, being on con-

secutive segments, 1, 2, 3, 4, 5, 6, 7, 8, and 9, with a third pair of spots on segment 3.

Of the six parasitized specimens only one has been fully dissected. Seven planidia were found in the body, one lying in the connective tissue of the mesothorax, a second embedded in the sternal muscle of seg. 4, a third lying near the nerve cord in seg. 6, a fourth in the connective tissue near the intestine in seg. 6, while the fifth, sixth and seventh were in the sternal muscles of seg. 7. Smith found the planidia in almost any position in the caterpillar's anatomy, although they generally floated out freely in the body cavity. If the planidia also floated freely in the body of *Conocephalus*, many may have been lost since the specimens had been opened and pinned ready for musculature dissections and then preserved in alcohol.

It is quite improbable that the true host of *Perilampus* is *Conocephalus*. It would seem rather that the planidium must require some parasite of *Conocephalus* in which to complete its development. This view is supported first by the fact of the life history of *P. hyalinus* and *Orasema*. The planidium of *P. hyalinus* lives at first within the body of the dipterous or hymenopterous host, but does not feed. When the host changes into the pupa, the planidium then emerges, lives ectoparasitically and commences to feed, protected by the puparium or the cocoon. The planidium of *Orasema* lives entirely ectoparasitically upon the pupae of soldiers, males or females of the harvesting ant, where the young planidium is usually found attached to the intersegmental membrane near the head.

Comparing the life history of *Perilampus* and *Orasema*, it is evident (as Thompson pointed out), that the stage spent by *Perilampus* in the body of the fall web-worm and the host is merely a prolongation of the migratory period in the life of the planidium, since the parasite neither grows nor feeds and can not complete its development until it becomes ectoparasitic.

In view of these facts of life history it is quite improbable that *Conocephalus* is the true host, for a development comparable to those just described would be impossible. One would expect that the planidium is seeking in the body of *Conocephalus* the larva of some parasite of the latter. As evidence for this theory we searched for records of the parasites of Orthoptera. In 1910 Swenk ('11) reared *P. hyalinus* from an undetermined sarcophagid which in turn was reared from *Melanoplus bivittatus*. In 1914 an important paper was published by Kelly (1914) based on his investigations of the sarcophagid parasites of grasshoppers. As hosts he found *Schistocerca americana, Melanoplus atlanis, M. femur-rubrum, M. bivittatus, M. differentialis* and *Dissosteira longipennis*. As an example of his records he states that in June 1913 there was quite a serious outbreak of grasshoppers, the prevalent species being *Melanoplus differentialis, M. bivittatus* and *M. atlanis*, with a few scattering individuals of other species. "The ground was strewn with dead nymphs and adults of the three species mentioned, which had died from parasitism of sarcophagids, their bodies being alive with maggots, while the fields were literally swarming with these flies engaged in striking adults and nymphs of each instar, except the first. Deposition of the larvae by the sarcophagid took place only while grasshoppers were flying or hopping." This last observation is important as evidence that it is not the

dead bodies that flies attack. Kelly demonstrated that the sarcophagid flies will strike at any moving object—at moths, butterflies, cicada or a piece of crumpled tissue paper. He threw into the wind such a paper and no less than six flies struck it. When the paper was examined, two tiny maggots were found clinging to it. From some 800 dead grasshoppers collected nearly 1,200 *Sarcophaga* of several species issued.

Kelly also observed four species of *Sarcophaga* ovipositing on the adults and nearly grown nymphs of *Chortophaga viridifasciata*, during late April and early May. Adults of these species of parasites issued from the first week in June till the first week in July. It was judged that there are probably five or six generations for the season.

Kelly reared *Perilampus hyalinus* as a secondary parasite from the Sarcophagids.

Many records from numerous observers are brought together in Kelly's paper, and although there are no records of the Sarcophagids being reared from the long-horned grasshoppers, yet is is probable that they too are parasitized.

Regarding the planidium from *Conocephalus*, we shall attempt this summer to investigate its life history further and hope to rear the adults. In following out this work I am much indebted to Prof. E. M. Walker for his advice and help. I wish also to thank Dr. L. O. Howard and Mr. S. A. Rohwer for references in the bibliography.

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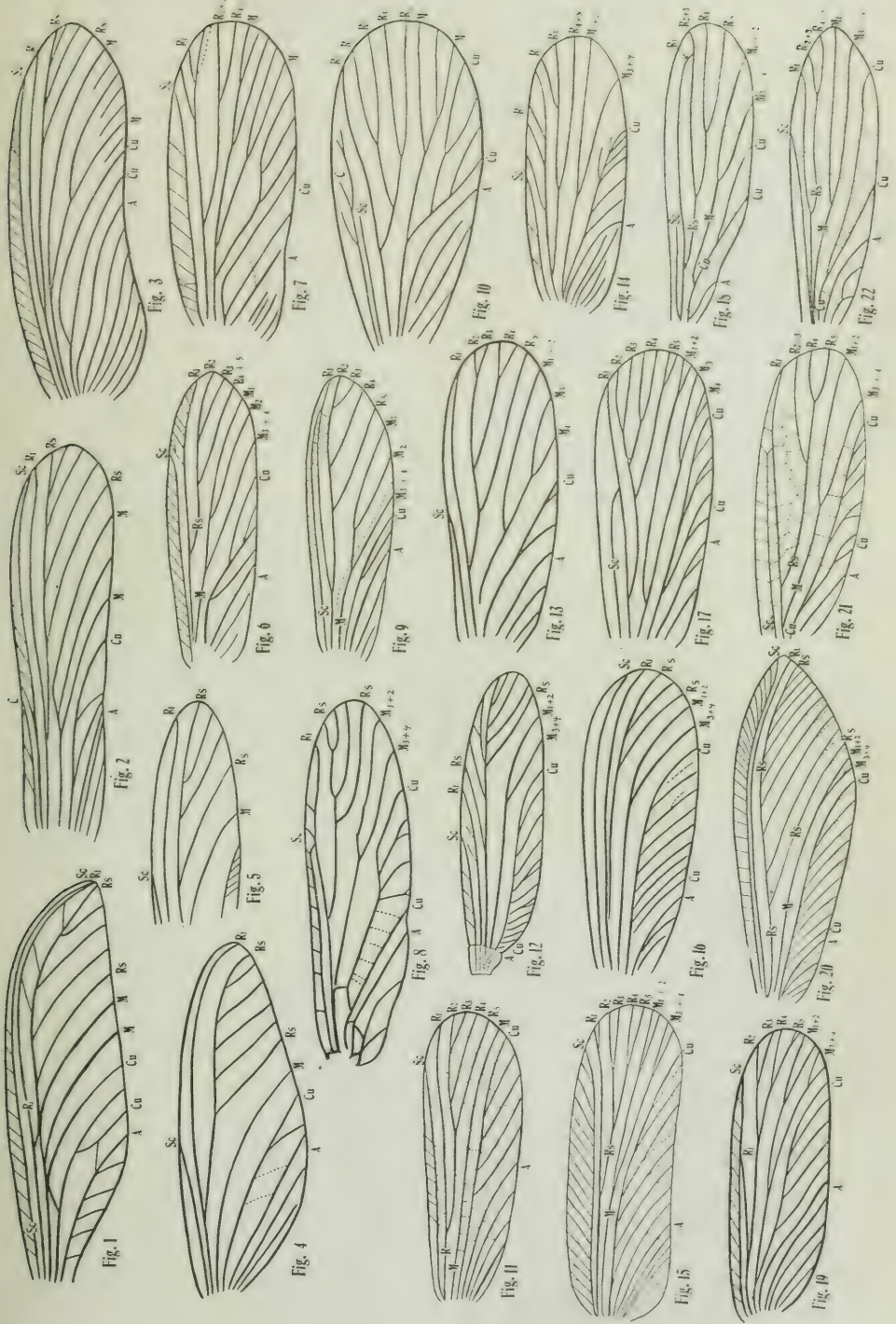
APPOINTMENT TO ENTOMOLOGICAL BRANCH, OTTAWA.

Canadian Entomologists will be pleased to learn of the appointment of Mr. C. H. Curran of Orillia, Ontario, to the position of Assistant Entomologist in the Division of Systematic Entomology, Entomological Branch, Ottawa. Mr. Curran, who has a well-earned reputation as a specialist in the Syrphidae, will have immediate charge under Dr. McDunnough, of the Diptera in the Canadian National Collection. A. G.



VENATION OF INSECT WINGS.

NOTES ON THE RELATIONSHIPS INDICATED BY THE VENATION OF THE WINGS OF INSECTS

BY G. C. CRAMPTON,

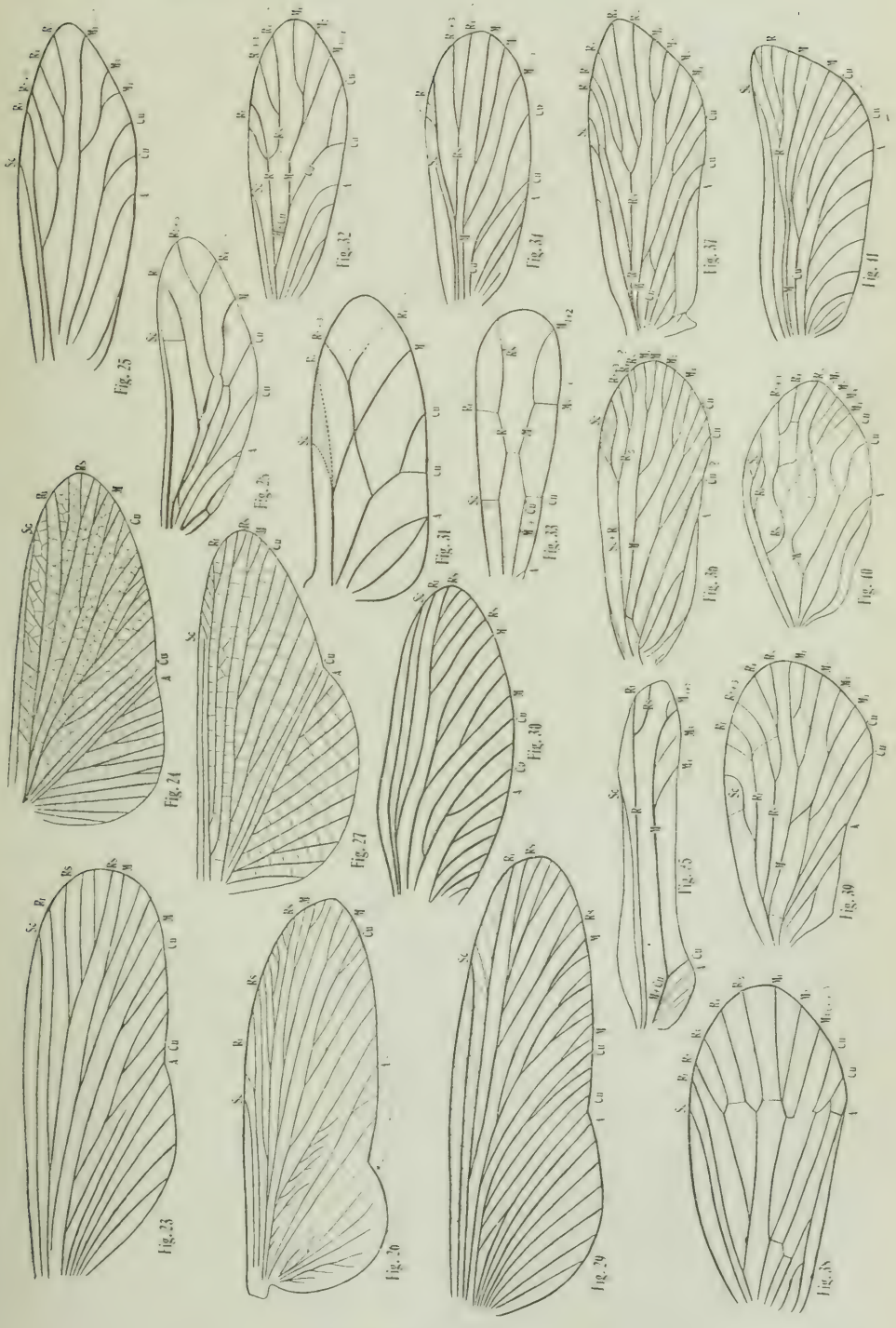
Massachusetts Agricultural College, Amherst, Mass.

Comstock and his students, and such investigators as Handlirsch, Tillyard, and others, have made available for comparison practically all of the more important types of wing-venation occurring in the different orders of insects; and in the following discussion, I would make use of the interpretations of the veins by these investigators, to point out wherein the evidence of the wings figured by them would support certain conclusions concerning the origin and interrelationships of the insectan orders, which I have reached from study of the parts of the body in general. While I feel that the interpretations of the veins, particularly the cubital and anal ones, (and more rarely the median veins also) are not correct in some cases, I have, nevertheless, followed the interpretations given by these investigators in each case, since my sole purpose at this time is to point out the similarity between the wings of certain insects, in support of my contentions as to the interrelationships of these forms, based upon the structures of other parts of the body; and the interpretations here given will in most cases serve the purpose sufficiently well.

The Palaeodictyoptera are considered by most of the recent students of venation as the direct ancestors of all other Pterygotan insects, and Handlirsch even considers them as ancestors of the Apterygota also. While the Palaeodictyoptera have departed but little from the types ancestral to the rest of the Pterygota, I do not think that they represent the actual ancestors of all other winged insects, and I am more inclined to regard them as a primitive group which branched off at or near the base of the common Pterygotan stem.

The Protodonata, (fig. 62) which are a primitive Odonatan type leading to the modern Odonata, are regarded as a distinct order by recent investigators, but I do not think that the character of the body in general of the Protodonata is sufficiently different from recent Odonata to justify placing them in a distinct order. The Protephemerida (fig. 63) on the other hand, seem to be different enough from their descendants, the Ephemerida, to be grouped in a distinct order. The Protephemerids and Protodonata are thought to be the descendants of the Palaeodictyoptera, but many of them have retained characters as primitive in some respects as the Palaeodictyoptera, and it is much more probable that the Protephemerida, etc., are descended from ancestors like those of the Palaeodictyoptera, rather than that the Protephemerida etc., are the direct descendants of the Palaeodictyoptera themselves. Certain immature Ephemerids exhibit characters extremely like those of *Lepisma*, *Machilis*, and other Apterygota which have departed but little from the condition typical of the ancestors of the first Pterygotan insects, and in many respects these immature Ephemerids are among the most primitive known Pterygotan forms. The wings of both Protodonata and Protephemerida are usually polyneurous, and the venation in the Protodonata in particular tends toward the unilateral type of branching. The venation of the Protephemerida, however, is not as similar as one might expect, and the

CAN. ENT. VOL. LIV. PLATE 6



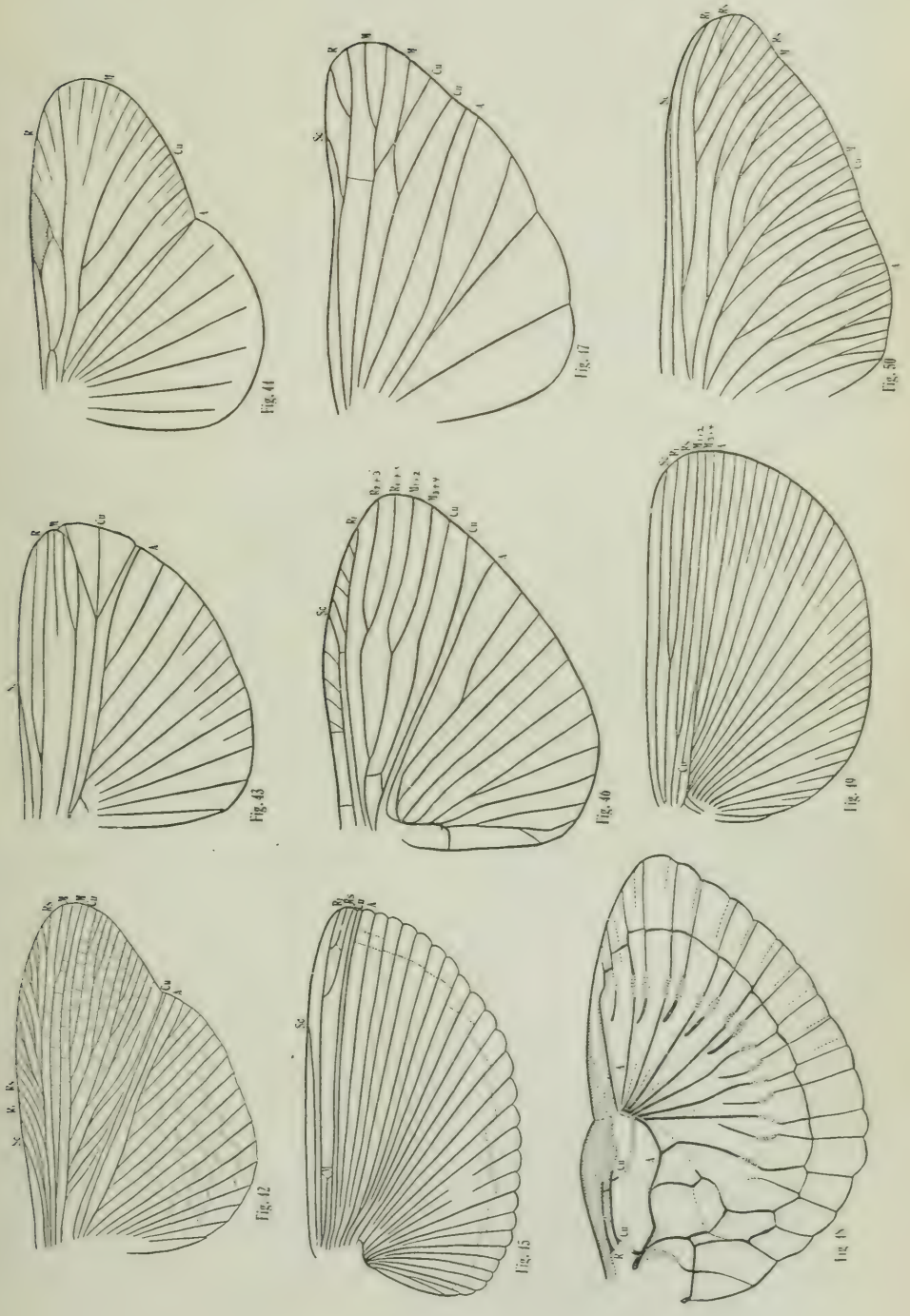
VENATION OF INSECT WINGS.

relationship between the two groups is not as close as is maintained by some investigators, nor does either type of venation approach that of the Plecoptera to any marked degree, so that the grouping of the Plecoptera with the Odonata and Ephemerida on the basis of their immature stages being aquatic, is a very artificial one, and apparently has no real phylogenetic significance. The venation of the Protodonata (and to some extent that of the Protephemerida) is rather suggestive of that of the Neuroptera in some respects, but the resemblance in this case is probably due to their mutual relationship to the Palaeodictyoptera. The lines of development of the Protodonata and Protephemerida apparently branched off at a very early period in the evolution of the Pterygotan types, and neither seems to be of any great value in the study of the evolution of the other Pterygotan types. The Protodonatan-Odonatan line of descent in particular is a very isolated one, leading along a path of specialization which does not approach very closely to that of any other group of insects, although the Protephemerid-Ephemerid line of development probably represents their nearest of kin (other than the Palaeodictyoptera), and the slight resemblance of the venation of both groups to that of certain Neuroptera is doubtless the result of convergent development.

The common ancestors of the Protoblattids and Protorthoptera are perhaps the most important of all insects for a study of the evolution of winged insects in general, since these two types exhibit many tendencies which were apparently carried over in the lines of development of the higher forms (so far as the wing venation is concerned) and a surprisingly large number of lower types apparently parallel their lines of development. If the hypothetical common ancestral stock from which the slightly diverging lines of the Protoblattida and Protorthoptera were descended be designated for convenience as the "Prodictyoptera," it would appear that the ancestors of these "Prodictyoptera" were related to the Protodonata and Protephemerida as well as to the Palaeodictyoptera, but their closest affinities were apparently with the Palaeodictyoptera. The Protoblattida are apparently somewhat nearer to the common ancestral stock than the Protorthoptera are, and the polyneurous tendency is the strongest in the Protoblattida, while many of the so-called Protorthoptera are markedly oligoneurous (if all of the forms called "Protorthoptera" by Handlirsch are really Protorthoptera—which seems very doubtful), and are quite highly specialized in their venation for such ancient insects. The wings of both Protoblattida and Protorthoptera are usually markedly "heteronomous," and in the hind wings of these forms (figs. 23, 29, 24, etc.) the precursor of the huge anal fan of the Orthopteroid insects makes its appearance.

Not only does the common ancestral stem of the Protorthoptera and Protoblattida form the central point about which the ancestors of recent insects are gathered, but many of the lines of descent of the earlier fossil orders are clustered about these forms, and their lines of descent in many instances parallel that of the Protorthoptera (and to a less degree that of the Protoblattida also) rather closely. Thus, the Synarmogoida (fig. 3) approach the ancestors of the Protorthoptera in many features, while they are clearly like the Palaeodictyoptera in other features. The character of the subcosta (Sc), radius one (R_1), and the

CAN. ENT. VOL. LIV. PLATE 7.



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radial sector (Rs) of Fig. 3 clearly suggests affinities with the Orthopteron shown in Fig. 2, while media and cubitus of Fig. 3 are like these veins in certain Protorthoptera—although the latter veins are more like those of the Palaeodictyoptera than those of the Protorthoptera. The character of the anal veins in Fig. 3 are as much like those of the Protorthoptera (and Protoblattids) as any insects, and taking their venation as a whole, the wings of the Synarmogoida would indicate that their line of descent arose near the base of the common stem of the Protorthoptera and Protoblattida at the point where these forms diverged from the Palaeodictyoptera, in emerging from their common ancestry. While the line of descent of the Synarmogoida parallels that of the Protorthoptera in certain respects, the Synarmogoida are a more or less isolated group of no great value for the study of the evolution of recent insects.

The venation of the Hapalopteroida as shown in Fig. 9 resembles that of the Protorthoptera and Orthoptera shown in Figs. 6 and 2 quite closely. It likewise exhibits certain points of similarity to the Mixotermitoid shown in Fig. 13, and there is also a slight resemblance to the Plecopterous wing shown in Fig. 8, but the Hapalopteroid line of descent is apparently a rather isolated one having no great value in tracing the lines of descent of recent insects. The Hapalopteroida possibly branched off from the base of the common Protorthopteron-Protoblattid stem near the point where the latter began to diverge from the Palaeodictyoptera, and the Hapalopteroid line of development parallels that of the Protorthoptera rather closely, and also approaches that of the Mixotermitoida in some respects.

The Mixotermitoida (figs. 13 and 17) resemble the Protorthoptera (figs. 6, 19, and 2) quite closely, and they also exhibit certain features of resemblance to the Hapalopteroida (fig. 9) and to the Reculoida (fig. 7) as well. There is a slight resemblance to the Hadentomoida (fig. 21) also, but the resemblance is not marked. The closest resemblance is to the Protorthoptera, and the line of descent of the Mixotermitoida probably sprang from a point near the base of the common Protorthopteron-Protoblattid stem, where the latter began to diverge from the Palaeodictyoptera, and the Mixotermitoid line of development parallels that of the Protorthoptera and Hapalopteroida as closely as any. The group is of no particular interest for the study of the evolution of recent insects.

Practically all of the features exhibited by the Sypharopteroida (fig. 4) occur in the wings of some Protorthoptera (such, for example, as the short subcosta, long radius, one unilaterally branching radial sector, single-"branched" media, etc.) They also resemble the Mixotermitoida (fig. 13) and Megasecoptera (fig. 1) in some respects. The line of descent of the Sypharopteroida apparently arose at the point of divergence of the common Protorthopteran-Protoblattid group from the Palaeodictyoptera, and paralleled the line of development of the Protorthoptera very closely. The fossil shown in Fig. 5, which Tillyard regards as a Protorthopteron, exhibits points of resemblance to both Protorthoptera and Sypharopteroida.

The wing of the Hadentomoid shown in Fig. 21 is somewhat like that of the modified descendant of the common Protorthopteron-Protoblattid stem,

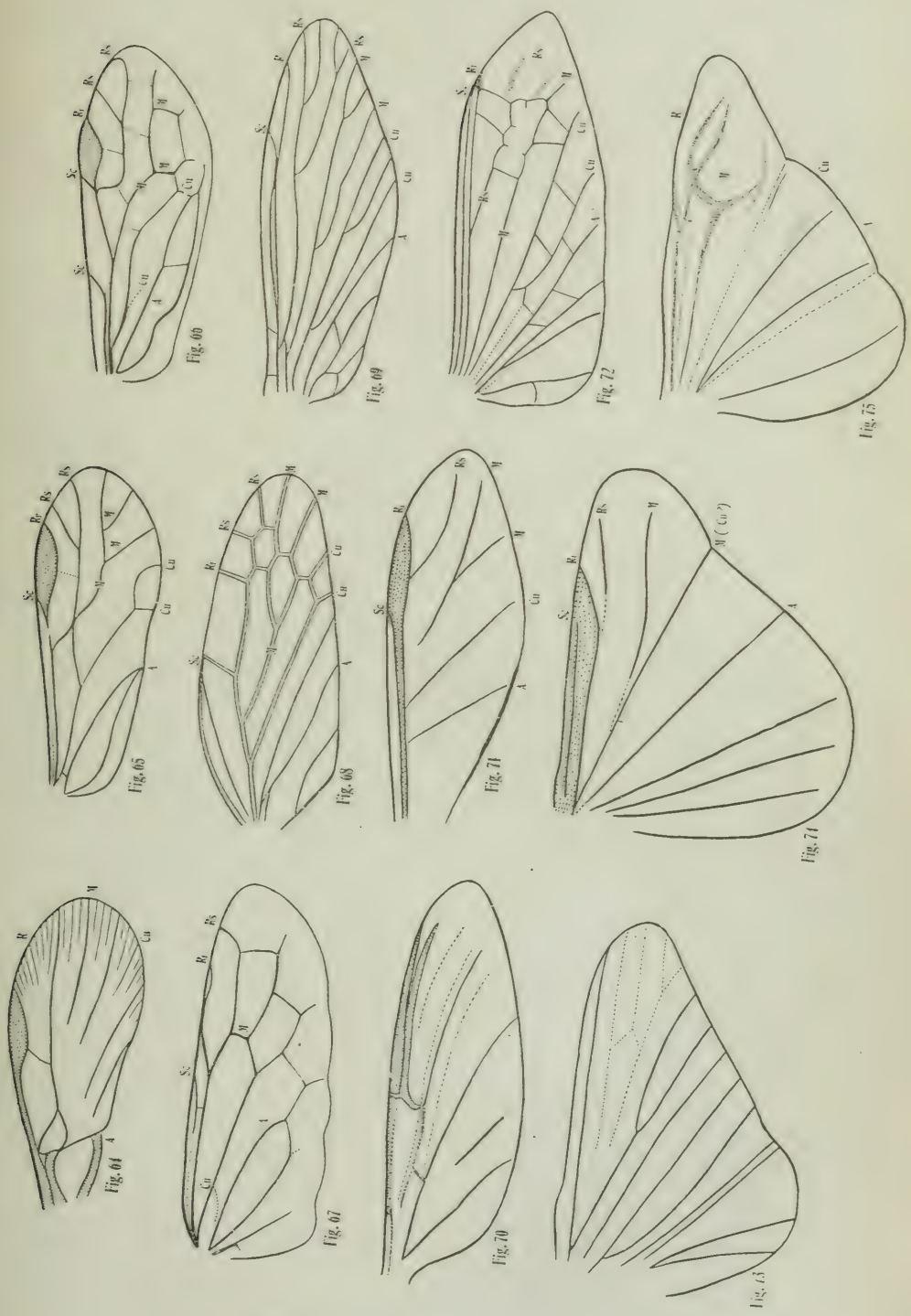
Fig. 53
Fig. 50
Fig. 59
Fig. 63
Fig. 52
Fig. 55
Fig. 58
Fig. 62
Fig. 51
Fig. 54
Fig. 57
Fig. 60
Fig. 61

shown in Fig. 14, and it is also faintly suggestive of the Mixotermitoida (figs. 13 and 17) and Hapalopteroida (fig. 9) in some respects. It is somewhat more like the Protorthopteron *Lepium* (not figured here) however, and the Hadentomoida probably arose near the base of the common Protorthopteron-Protoblattid stem at the point where the latter diverged from the Palaeodictyoptera. The Hadentomoida exhibit certain features suggestive of a relationship to the Plecoptera (figs. 22 and 8), and also to the Embidiina (fig. 18), so that their line of development is of some interest for the study of the evolution of certain recent forms.

The Reculoida (fig. 7) resemble the modified descendant of the common Protorthopteron-Protoblattid stem shown in Fig. 10, and they also resemble the Protorthoptera (fig. 6) quite closely. Their line of descent probably branched off near the point of divergence of the common Protoblattid-Protorthopteran stem from the Palaeodictyoptera, and their line of development parallels that of the Protorthoptera fairly closely.

The wing of the Megasecopteron shown in Fig. 1 is perhaps as much like that of a Palaeodictyopteron (fig. 30) as any other, but it clearly approaches the Protorthopteran and Orthopteran types (fig. 2) in the tendency for media to unite with the radial sector, and for cubitus to unite with media. The Megasecoptera resembles the Sypharopteroida (fig. 4) in certain respects, and they also bear a rather faint resemblance to the Protephemerids and Synarmogoida (fig. 3) in certain features, but their closest affinities are with the Palaeodictyoptera and Protorthoptera, and their line of development apparently arose near the point where the Palaeodictyoptera began to diverge from the common ancestors of the Protorthoptera and Protoblattida, and paralleled the line of development of the Protorthoptera rather closely, while it approached the lines of development of the Sypharopteroida and Synarmogoida only slightly. Since certain tendencies observable in the Megasecoptera find opportunity for fuller expression in the Neuropteroid insects, the study of the Megasecoptera is of considerable value in tracing the origin of the higher insects.

In taking up the consideration of the evolution of recent insects, we find that here also, the study of the venation of the Protoblattida and Protorthoptera is of prime importance, as was likewise the case in studying the evolution of the earlier fossil forms, since the lines of development of recent forms as well as the earlier fossil types, tend to group themselves about the Protoblattida and Protorthoptera, which, judging from their wings, were a variable group in an active state of evolution. I have grouped the recent orders Blattida, Mantida and Isoptera into a single superorder (the "Panisoptera"), and I would point out the fact that the evidence of the venation of the wings is in full accord with that drawn from a study of other features of the body, which indicate that the group mentioned above is a natural one. The wings of the Protoblattida clearly indicate that the Protoblattids are the nearest representatives of the precursors of the Blattida, and if one compares the hind wing of the Mantid shown in Fig. 27, with that of the Protoblattid shown in Fig. 24, it is quite evident that the Protoblattids are the nearest representatives of the precursors of the Mantids also; and both Blattids and Mantids apparently arose



VENATION OF INSECT WINGS.

from the same source in the common Protoblattid-Protorthopteron stock. Similarly, the hind wing of the Isopteron shown in Fig. 26 is very similar to that of the Protorthopteron shown in Fig. 29, and also resembles extremely closely the hind wings of the Protoblattid shown in Fig. 23. The Isoptera, therefore, in all probability arose from the same source in the common Protoblattid-Protorthopteron stock which gave rise to the Blattids and the Mantids. Although the alaflabellum, or anal fan, of the Isopteron shown in Fig. 26 is not typical of all Isoptera, the termite there figured is a very primitive one, and its condition clearly indicates that certain of the ancestral Isoptera had well developed alaflabellum, which they evidently inherited from ancestors of the common Protorthopteron-Protoblattid stock.

The precursor of the anal fan of the Protoblattids and Protorthoptera is suggested by the broadening of the basal portion of the hind wings of such Palaeodictyoptera as the one shown in Fig. 50, but it is not very probable that this Palaeodictyopteron represents very closely the type which gave rise to the common Protorthopteron-Protoblattid stock. The alflabellum is enormously developed in the Orthopteroid descendants of the Protorthopteron-Protoblattid stock (figs. 48, 49 and 45) and it is also large in the Plecopteron shown in Fig. 46 (which was also derived from ancestors resembling the Protoblattids and Protorthoptera in many respects.)

I have grouped the Plecoptera and Embiidina in a common superorder (the "Panplecoptera"), and the venation of the wings would clearly support such a grouping, as may be seen by comparing the wing of the Plecopteron shown in Fig. 22 with that of the Embiid shown in Fig. 18. Both of these wings resemble that of the Hadentomoid shown in Fig. 21, rather closely, and the wings of the Plecoptera (figs. 22 and 8) are rather suggestive of the Hapalopteroida (fig. 9) in some respects. The Plecoptera, however, in all probability were derived from ancestors closely resembling the common Protorthopteron-Protoblattid stock (and also related to the Palaeodictyoptera) from which the Isoptera were descended, since the wing of the Plecopteron shown in Fig. 8 is extremely similar to that of the Isopteron shown in Fig. 12, and both lead back to the Protorthopteron-Protoblattid types shown in Figs. 19, 11, 15, etc. If the termite-like insect shown in Fig. 16 is really a Neuropteron, the venation of some Neuroptera evidently approach the type of Isopteran and Plecopteran venation shown in Figs. 12 and 8, thus suggesting that the origin of the Plecoptera was not far from the point of origin of the Neuroptera also. The huge anal development in the hind wing of the Plecopteron shown in Fig. 46 would indicate that the primitive Plecoptera sprang from the same stock which gave rise to such Blattids as the one shown in Fig. 42 (and 43), thus lending further weight to the view that the common Protorthopteron-Protoblattid stock represents quite closely the ancestors of the Plecoptera (and their allies the Embiidina), and the lines of development of the Plecoptera and Embidiina parallel those of the Protorthoptera and Protoblattida quite closely, while they approach the Hadentomoida and Hapalopteroida only slightly. It should be borne in mind that the Embiid type of wing approaches the Isopteron type almost as closely as the Plecoptera mentioned above do, but it has not seemed necessary to include fur-

ther figures to demonstrate this fact, since it is quite patent that the Embiidina and Plecoptera are so closely related that what applied to one applies to the other, as well.

The Dermaptera, Phasmids, Grylloblattids, and saltatorial Orthoptera are here grouped in the superorder "Panorthoptera." The Dermaptera were formerly grouped with the Embiidina and Plecoptera, but it is preferable to place them nearer the Phasmids, saltatorial Orthoptera, etc., than was done in the former grouping. In the enormous development of the anal area, and the accompanying reduction of the preanal region (i. e. the region in front of the anal area) the Dermapteron wing shown in Fig. 48 approaches the Orthopteron and Phasmid shown in Figs. 45 and 49, and the "floating" or intercalary veins, which are not attached basally, and occur between the anal veins (of which they are probably detached branches), are rather similar in the insects in question. The paramarginal line extending almost parallel to the margin of the wing in the insect shown in Fig. 48, was possibly formed by the joining, end-to-end, of certain of the cross veins, some of which are shown in Fig. 45. The wings of the Dermaptera (Fig. 48) likewise approach the Blattid wings shown in Figs. 43 and 44, and they are also suggestive of the wing of the Plecopteron shown in Fig. 46. From these resemblances, we may conclude that the Dermaptera arose from the common Protorthopteron-Protoblattid stem very near the point at which the lines of development of the Phasmids and saltatorial Orthoptera branched off, but the general character of the body in general would preclude the possibility of deriving the Dermaptera from saltatorial Orthoptera. It is likewise very probable that the line of development of the Dermaptera arose near the point of origin of that of the Blattids and of the Plecoptera (with the Embiidina) as well, and this would account for the general resemblance of the Dermaptera to the Plecoptera and Embiida, as well as to the Blattids, Mantids and Isoptera, since they all arose near the same point, though the line of development of the Dermaptera follows that of the Phasmids and saltatorial Orthoptera (with the Grylloblattids) more closely than any other forms. In this connection, it may be mentioned that the Hemimeridae are merely modified Dermaptera, and the Grylloblattids are probably very primitive Orthoptera closely related to the Protorthoptera and Protoblattids. The wings of the Phasmids (Fig. 49) would indicate that their closest affinities are with the saltatorial Orthoptera (Fig. 45), although in the general character of their external anatomy, they are extremely closely related to the Grylloblattids and Dermaptera, and likewise exhibit certain points of resemblance to the Plecoptera and Embiids, as well as to the Mantids, Isoptera, and Blattids (compare also the wings shown in Figs. 43, 42, and 46 with Fig. 49.) The Phasmids apparently sprang from the common Protorthopteron-Protoblattid stock very close to the point where the true Orthoptera (with the Grylloblattids) and Dermaptera arose, and also not far from the point of origin of the Blattids (with the Mantids and Isoptera) and the Plecoptera (with the Embiidina) also. The line of development of the Phasmids, however, parallels that of the saltatorial Orthoptera (with the Grylloblattids) extremely closely; and the wings would indicate that their closest allies are among the saltatorial Orthoptera and Dermaptera, and also that the Blattids are their next closest allies. The body in general of the Phasmids is much more primitive

than that of the saltatorial Orthoptera, and it is infinitely more probable that the Phasmids branched off near the base of the Orthopteran stem, than that the Phasmids were derived from the saltatorial Orthoptera.

(To be continued.)

THE PERMANENT BUREAU OF ALL-RUSSIAN ENTOMO-PHYTO-PATHOLOGICAL CONGRESSES IN PETROGRAD, RUSSIA.

The Permanent Bureau of All-Russian Entomo-Phytopathological Congresses, Liteyny, 37-39, Room 59, Petrograd, Russia, desires:

1. To *exchange printed matter* (published since 1914) on entomology, phytopathology, mycology and zoology, with American colleagues, Scientific Societies, Agricultural Experiment Stations, Museums of Natural History, periodicals, etc.

2. To receive from *American publishers catalogues* and specimen numbers of various publications on the above mentioned subjects.

3. To receive *catalogues* and price-lists from American firms dealing in various *apparatus and chemicals* used in combating the plant injurers.

The above mentioned Permanent Bureau has supplied credentials to Mr. D. N. Borodin (who also represents the Bureau of Applied Botany of the Russian Agriculatural Scientific Committee, Petrograd) to collect literature in this country and give all the necessary information to the American colleagues, concerning entomological work conducted in Russia, and to organize an exchange of literature.

Mr. Borodin will accept all packages with books, bulletins, etc. for Russia, if they will be addressed to him at No. 110 West 40th Street, Room 1603, New York City.

BOOK NOTICE

Volume X, No. 1 of the University of Iowa Studies contains three entomological articles.

I. Report on the Scutelleroidea collected by the Barbadoes-Antigua Expedition in 1918 by Dayton Stoner.

Seventeen species are recorded. The report is well illustrated and many interesting observations on the habits, food plants and distribution of the various species are given.

II. Report on the Orthoptera and Dermaptera of the same Expedition by A. N. Caudell.

Thirty-one species are treated of, distributed as follows:—Forficulidae, 2; Blattidae, 8; Mantidae, 2; Phasmidae, 2; Acrididae, 7; Tettigonidae, 3; Gryllidae, 7.

One new species of Blattidae, *Eurycotis similis*, one new Acridian, *Amblytropidia stoneri*, and two new Gryllids, *Cycloptilum minimum* and *Hetrecous? dubius* are described.

III. The Scutelleroidea of the Douglas Lake Region by Dayton Stoner.

Twenty-seven species are listed as occurring in the vicinity of this northern Michigan Lake and numerous valuable ecological notes are given under the various specific headings. J. McD.

Mailed Thursday, November 23rd 1922.

The Canadian Entomologist

VOL. LIV. ORILLIA, OCTOBER, 1922. No. 10.

POPULAR AND PRACTICAL ENTOMOLOGY

The Cocklebur Billbug*

BY F. H. CHITTENDEN,

U. S. Department of Agriculture.

The excessive price of commercial oils during war times led to more extensive cultivation of oil-producing plants, such as the castor bean and sunflower. The seeds of the latter are cultivated in Kansas and neighboring States in the Middle West and the oil therefrom utilized for the manufacture of oil-cake for lighting purposes, for woollen dressing, candle and soap-making. The oil-cake and seeds are useful foods for stock and poultry, and the seeds also for cer-

Fig. 1—*Rhodobaenus* 13-*punctatus*: a, common form of beetle; b, head and beak of female; c, same of male—all enlarged.

tain cage birds. Complaints have been made during recent years in regard to weevils which affect cultivated sunflower. For several years past the writer has had under observation a rhynchophorous larva which inhabits the stems, known as the cocklebur billbug (*Rhodobaenus* 13-*punctatus* Ill.). The following notes are submitted as of interest in connection with the growing of sunflower for commercial use.

**Rhodobaenus tredecimpunctatus* Ill.; family Calandridae; order Coleoptera.

August 16, 1905, Mr. Geo. H. McNeill sent specimens to the Bureau of Entomology in the adult and pupal stages from Jackson, Tenn., where the species was injurious to dahlia. All of his plants had been attacked by the larvae, described as boring upwards through the pith of the stem and then through the branches. This greatly injured the vitality of the plants, the stalks being weakened, and caused the plants to break down by their own weight. What few blooms were borne were small and inferior, and the plants were so badly infested as to be of no value that year. Pupae were seen as late as August 31. Soon thereafter, this species came to the attention of Dr. E. G. Titus in its occurrence on sugar beet, there being evidence that the larvae could breed in seed-stalks. August 6, 1921, Mr. W. V. Reed, Assistant Entomologist, State of Georgia, sent this beetle from Atlanta, Ga., with statement that it was quite a pest on dahlias in that State. A few plants were injured by this insect in previous years, but that year it had done very considerable damage to dahlias. The weevil seemed to lay its eggs in the axil of the plant and the "grub" eventually killed the plant by boring the stem. August 16 our correspondent sent dahlia stalks showing the work of the larva within, stating that injury appeared to be worse when the dahlia stocks were more or less young and tender. In the older stalks it weakens them and lessens their vitality considerably. Larvae were about full grown at this time.

The Beetle

This insect is a gaily-colored red and black snout-beetle of the family Calandridae. As the scientific name indicates, it is ornamented with thirteen spots, arranged in typical examples about as illustrated by figure 1, but individuals from the South commonly occur in which these spots become merged into bands.[1] From our native corn billbugs (Sphenophorus) and their allies, to which this species is related, it may be distinguished at once by its color, its much more strongly curved beak, and differently shaped antennae. The beetle measures usually less than half an inch in length, but specimens vary from one-fourth to fully one-half of an inch.

Distribution

The distribution is remarkably wide. It occurs from the Atlantic to the Gulf regions, and is about equally common on the Pacific Coast. It does not appear to inhabit territory north of the Transition life zone, and is common in Mexico and Central America, as also in Columbia, S. A.

The beetles are somewhat free fliers, in which respect they differ from most known species of *Sphenophorus*.

The first account of this species was by Riley in 1871.[2] A short account was given by the same writer ten years later.[3] In the latter the larval characters are briefly indicated.

1—A dark variety, *quinquepunctatus* Say, occurs in Florida, in which there are only five spots, those on the thorax, and in which the elytra are wholly black on the disk. It is an exceedingly variable species, no less that 22 synonyms and 16 forms having been recognized (Champion, Biol. Centr. Amer., Coleop., Vol. IV, pt. 7, pp. 149-150, 1910).

2—Riley, C. V. Third Missouri Report, p. 60, 1871.

3—Report Comm. Agr. for 1881-82, p. 142.

The Larva

The larva (fig. 2) compared with Sphenophorus "has a more slender form, the anal segment is protuberant, armed with two blunt terminal spines; the head is broadly rounded, not vittate, mandibles bidentate, ligula emarginate, not ciliate; the ocelli occupy the same relative positions upon the front margin as in Sphenophorus, but are larger, convex, lenticular, with pigment spots plainly visible beneath." In other respects the larvae of these two genera agree very closely, even to the folds of the body-joints and the position of the occipital depressions and bristles.

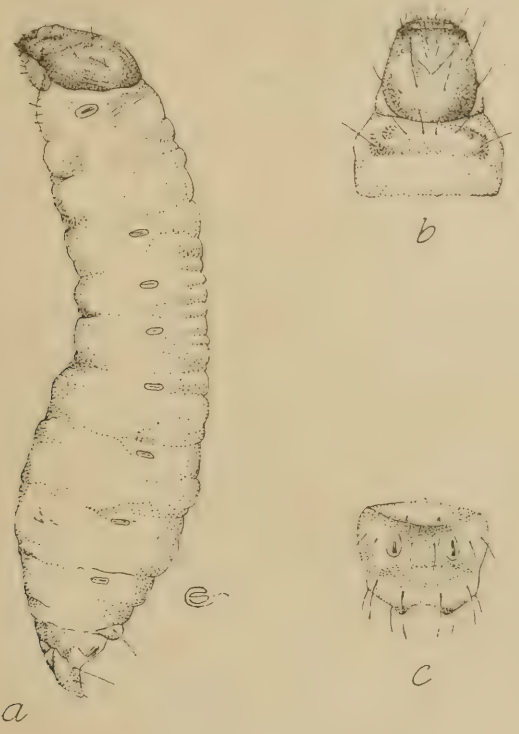


Fig. 2—*Rhodobaenus 13-punctatus* larva; a, lateral view; b, head and first thoracic segment; c, dorsal view of anal segment, enlarged.

Food and Other Habits

In 1889, F. M. Webster[4] noted the occurrence of the larva in the pith of garden sunflower, the beetle developing September 8.

In 1900 the writer published a note on this insect and its occurrence in the vicinity of Washington, D. C.[5]

This species breeds in the stems of various wild plants, chiefly Compositae, its known host plants include the Joe-Pye weed (*Eupatorium*), leaf-cup (*Polymnia*), cocklebur (*Xanthium*), thistle (*Cirsium*), ragweed (*Ambrosia*), ironweed (*Vernonia*), Silphium, wild and cultivated sunflower (*Helianthus*), and

4—Insect Life, Vol. 1, p. 382, 1889.
5—Bul. 22, n. s., Div. Ent., U. S. D. A., pp. 104-105, 1900.

ornamental dahlia. Its occurrence on sugar beet is exceptional. It is frequently associated with other insects, notably with the clover stem-borer *Languria mozardi* Latr.).

The hibernated imagos appear in the District of Columbia in early May, and although oviposition has not been observed, judging from analogy, the eggs are deposited in holes which the female cuts in the stems while they are still young and tender. The larvae bore through the pith, and when mature form a cell in which they transform to pupae and afterward to adults. Newly-bred imagos occur from the middle of August until the first week of September.

Natural Enemies.

Two parasites of this species have been observed, the chalcidid *Habrocytus rhodobaeni* Ashm., reared by the writer from larvae from Rosslyn, Va., and described in 1896[6], and an undescribed chalcidid.

NOTES ON *EXYRA SEMICROCEA* GUEN. AND FORM *HUBBARDIANA* DYAR. (LEPIDOPTERA)

BY F. H. BENJAMIN,
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While on an inspecting trip to southern Mississippi the author had the opportunity to view these interesting little Noctuid moths in their natural habitat.

Twenty miles north of Gulfport, on the Dixie Highway, Professor Lobdell, Mr. Langston and the author were examining low lands with the idea of attempting to ascertain the extent of damage to be anticipated to crops by crayfish.

Here, *Sarracenia flava* was present in vast numbers. This is the well known Pitcher Plant of our southern wet lands, which annually destroys vast numbers of insects. The normal insect, entering the funnel shaped leaf, is unable to find its way out, and is actually digested by the fluids in the bottoms of the leaves. This is a most remarkable instance of plant specialization, but still more remarkable is the fact that this plant has a set of enemies belonging to the genus of moths known as *Exyra* who are especially adapted throughout their entire life cycle to live within the "pitchers" of these plants.

Unfortunately the author was unable to view the egg laying of these remarkable moths, but found every other stage, from minute larvae through pupae to adults. Heretofore, these moths were not common in collections, as they apparently are not very much attracted to light. A light burned in a locality infested with the insects failed to attract any specimens. Most of the specimens in collections have either been found accidentally, or carefully reared from larvae. The latter is a very arduous undertaking as the food-plant does not thrive well outside of the native wet acid soils in which it grows.

All stages of the larvae were found within the "pitchers," eating as a usual thing only the protected inside tissue, and thus undoubtedly gaining a high degree of protection against natural enemies. Occasionally the leaf tissue

6—Trans. Amer. Entom. Soc., Vol. XXIII, p. 220, 1896.

was eaten through, but this appeared to be an accident, rather than the normal mode of feeding. When about half grown the larva constructs a web across the mouth of the leaf in which it lives. There is only a single individual to a leaf, although they do not appear to be carnivorous, and a number were successfully carried in a tin box for several days.

When ready to pupate, the larva forms a cocoon of frass and silk, in the slender part of the "pitcher"; having spun, just above this cocoon, a stiff web of silk which seems to be a very effective protection against disturbance from above. These stiff webs appear to be a sure indication of a pupating larva or pupa below. Before pupating the larva eats the leaf so that merely a shell of very thin tissue, in the form of a round spot, remains between it and the outside world. Is it to be concluded that the adult pushes its way through this thin shell? Certainly the pupa does not do so, for it remains snugly within its cocoon, and is not found half way out of the plant, as is the case with the *Cossidae*. However, the front of the adult is in the shape of a sharp pointed cone, undoubtedly fitted for pushing its way through something, and it seems almost certain that this is the means of emergence to the outside world.

After the adult has emerged, and left the old "pitcher", it seeks a new green "pitcher" for its hiding place. It never enters an old "pitcher" unless seeking an immediate hiding place from threatened danger, and then never if a fresh green "pitcher" be close at hand. It is very peculiar that these moths should always select the green leaves, from one to five adults being regularly found within each green "pitcher". Almost every green "pitcher" had at least one moth resting within it, whereas the only specimens taken in old "pitchers" were moths which were frightened out of the green "pitchers" and entered the others to hide.

About forty specimens were caught in the green "pitchers" in less than half an hour, surely an easy way to obtain a series which had heretofore been scarce in collections.

The specimens found represented both the typical form and Dr. Dyar's variety, *hubbardiana*. Not only were both forms found, together with all manner of intergrades, but also forms carrying the *hubbardiana* idea still further, until only the merest trace of any dark maculation was visible on the ground color. This aberration may be known as **immaculata,** ab. nov.

Type Locality: 21 miles north of Gulfport, Mississippi.

Dates of Capture: 26th of June, 1921.

Number and Sexes of Types: Holotype ♂, deposited as loan material in the collection of Dr. William Barnes; 1 paratype, collection of author; 2 paratypes, collection of Agricultural and Mechanical College, Mississippi.

Mr. Mortimer L. Higgins, Washington, D.C., reports the capture of approximately 100 specimens of the beetle *Oxyneuus histrina* (Nitidulidae) on a single plant of the Stink Horn Fungus (*Phallus impudicus*). The capture of more than one or two specimens on a single plant is very rare, according to Schwarz, Barber and Leng, and the record therefore should be of interest to Coleopterists.

NOTES ON THE RELATIONSHIPS INDICATED BY THE VENATION OF THE WINGS OF INSECTS.

BY G. C. CRAMPTON,
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(Continued from page 216)

I have pointed out the close resemblance between the Zoraptera and the Psocids in several papers (Crampton, 1921 and 1922) and I would now definitely place the Zoraptera in the order Psocida, assigning to the Zorotypoidea the rank of suborder, or superfamily. The discussion of the origin of the Zoraptera would therefore resolve itself into the question of the origin of the Psocids in general, since what applies to one branch of the Psocids applies to all. A comparison of the wing of the Psocid shown in Fig. 32 with that of the Protorthopteron shown in Fig. 34 would indicate that the Psocids and Protorthoptera are extremely closely related, and in all probability the line of descent of the Psocids branched off from the common stem of the Protorthoptera and Protoblattida. This view is in harmony with the fact that the wings of certain Psocids are suggestive of the type occurring in some Blattids (compare Fig. 65 with Fig. 64) since the Blattids also arose from the common Protorthopteron-Protoblattid stem, and much the same tendencies (i. e. the same genes, determinants, or factors) could enter both the Psocid and Blattid lines of descent, having been inherited from their common ancestry. The wings of the Zoraptera are quite suggestive of a relationship to the Isoptera (and the venation of other Psocids is rather faintly suggestive of Isopteron affinities) and this also would indicate that both Psocids and Isoptera were descended from ancestors very like the Protorthoptera (with the Protoblattida.) The resemblance between the wing of the Psocid shown in Fig. 32, and that of the Mixotermitoid shown in Fig. 13 may be due to their mutual relationship to the Protorthoptera, but it is quite possible that the point of origin of the Psocid line of development may have been quite close to the point at which the Mixotermitoid line of development branched off from their Protorthopteron-like ancestors, and the resemblance would therefore be due to consanguinity, rather than to "convergence." The marked resemblance between the wings of such Psocids as *Zorotypus* and the Embiids (with the Plecoptera) has been discussed in several papers (Crampton, 1921 and 1922) and, although both *Zorotypus* and the Embiids are closely related to the Protorthoptera, the resemblance between them is not due solely to their mutual relationship to the Protorthoptera, but is due to a more direct relationship between the Psocids and Embiids (with the Plecoptera), and it is extremely probable that the line of descent of the Psocids branched off near the base of the common Protoblattid-Protorthopteron stem very close to the point of origin of the common ancestors of the Embiids and Plecoptera; and the insects related to the Blattids (with the Isoptera) "took their origin" very near this point also.

The Psocids, Mallophaga, Pediculids, Thysanoptera, and Hemipteroid insects (i. e. Hemiptera and Homoptera) have been grouped in a single superorder, the "Panhomoptera," and a study of the venation of the groups in question would lend weight to the correctness of this grouping. The Psocids were

evidently descended from ancestors very like the Protorthoptera, (with their allies the Isoptera) and the Thysanoptera were apparently descended from ancestors resembling the modified descendant of the Protorthoptera shown in Fig. 35, as may be seen by comparing Fig. 33 with Fig. 35. The mutual resemblance between the wings of certain Psocids and the Thysanoptera has been discussed elsewhere (Crampton, 1922) and need not be described here, so that it is not necessary to do more than call attention to the fact that the relationship between the Psocids and the Thysanoptera is more direct than through the mediation of their mutual relationship to the Protorthoptera (and the Orthopterous descendants of the Protorthoptera.) The Pediculids are apparently quite closely related to the Mallophaga, (and Platypsyllid Coleoptera also) though both are wingless groups, and nothing is known of their more direct winged ancestors, though both were doubtless derived from Psocid-like forms, as is indicated by their general body characters. The Mallophaga in particular are extremely like Psocids in the character of their head structures, thoracic plates, etc., but they are also astonishingly like the members of the Coleopterous group Platypsyllidae in certain respects (and they also have certain features in common with the Hemimerid family of the Dermaptera.) If the Psocids, Dermaptera and Coleoptera are all to be derived from Protorthopteroid ancestors, this complicated interrelationship of the Mallophaga to all of these orders is readily comprehensible; but if this view is inadmissible, the resemblance between the Mallophaga and the Hemimerid Dermaptera, for example, must be regarded as a result of convergent development due to the selective action of similar environmental conditions (ectoparasitism.)

Judging from their general structure, the Thysanoptera are more closely related to the Hemipteroid insects than to the Psocids, but since the Psocids themselves are quite closely related to the Hemipteroids the dual relationship of the Thysanoptera to the Psocids and to the Hemipteroids is quite readily comprehensible. The remarkable parallelism in the venation of a long series of Psocids and Homopterous Hemipteroid insects has been discussed in a previous paper (Crampton, 1922) and the Psocids parallel the Homoptera so closely that it would be very appropriate to designate the Psocids as "Parahomoptera" rather than as "Psocoptera," as is done by certain recent entomologists—especially since all of the Psocoptera are not *Psocus*-winged (e. g. the wings of *Embidopsocus* are nothing like those of *Psocus*) and the designation "Psocoptera" is not at all appropriate for such Psocids as these, while even *Embidopsocus* parallels the venation of certain Homoptera, as was pointed out in the article referred to above.

Since the wings of the Psocids parallel those of the Homoptera so remarkably closely (apparently due to the inheritance of many common genes, determinants or factors from a common source) we would expect that if the Psocids were derived from ancestors closely related to the common Protorthopteron-Protoblattid stem, the Homoptera would also be derived from ancestors extremely similar to these forms, and indeed, certain Homopterous wings are very suggestive of those of certain Protorthoptera, while such a Homopterous wing as the one shown in Fig. 58 approaches quite closely that of the descendant of the common Protorthopteron-Protoblattid stem shown in Fig. 59, and a surpris-

ingly large number of anatomical features of Hemiptera are "Blattoid." In fact, it would be quite impossible to derive such a type as the Homopterous wing shown in Fig. 58 from that of *Eugereon* (Fig. 41) which is supposed to represent the type ancestral to the Homoptera and Hemiptera (Heteroptera), so that it is much more probable that the ancestors of the Homoptera and Hemiptera were very like the common Protorthoptera-Protoblattid stem, and the common ancestors of the Homoptera and Hemiptera apparently arose at the point where the common stock of the Protorthoptera and Protoblattida began to diverge from the Palaeodictyoptera, and *Eugereon* doubtless branched off from the same point, or very near it. *Eugereon*, however, is more like the Palaeodictyoptera (compare figs. 41 and 30), and it possibly may be regarded as a specialized Palaeodictyopteron. In stressing the close relationship of the primitive Homoptera to the common Protorthopteron-Protoblattid stock, I would not minimize the fact that the Homoptera have also taken over traits from the Palaeodictyoptera into their line of development, but these are to be regarded more as persistent features coming up from the common stock which gave rise to both Palaeodictyoptera and the Protorthoptera-Protoblattida—and the Homoptera apparently arose at the point where these two lines began to diverge from their common ancestry. The line of development of the Megasecoptera also apparently branched off near this point, so that the ancestors of the Homoptera were doubtless related to the Protoblattid-Protorthopteron stock, and to the Megasecoptera, Protohemiptera and Palaeodictyoptera as well. The line of development of the Hemipteroids, however, apparently parallels that of the Protoblattid-Protorthopteron stem and the forms descended from it such as the Psocids, etc., and the Hemipteroids also approach the Neuropteroid types (which were derived from a similar source) in many respects.

The Psocids, and their allies the Hemipteroids, etc., parallel the Neuropteroid insects quite closely in many respects, as was mentioned above, and I am convinced that this parallelism is due to the inheritance of the same genes, determinants or factors (albeit these are modified by differing factors in the different orders) from a common source, rather than that the marked resemblance between the forms in question is due to "convergence" (i. e. the similarity is the result of consanguinity rather than to the operation of similar environmental influences). The resemblance between the wings of the Homoptera and the Lepidoptera is well known, and the similarity between the wing of the Psocid shown in Fig. 32 and that of the Lepidopteron shown in Fig. 54 is unmistakable The resemblance between the Psocid shown in Fig. 32 and the Trichopteron shown in Fig. 25 is quite marked, and the resemblance between the Psocid, Homopteron and Trichopteron wings shown in Figs. 40, 39 and 38 is very striking, as is also the resemblance between the wing of the Homopteron shown in Fig. 36 and the Trichopteron shown in Fig. 37 (or the Mecopteron shown in Fig. 52). The most instructive and important resemblance, however, is that between the Psocid shown in Fig. 65 and the Hymenopteron shown in Fig. 66, and when these two wings are compared together, and that of the Hymenopteron shown in Fig. 66 is compared with the Homopterous wing shown in Fig. 68, it would appear very probable that the veins interpreted as the fourth and fifth branches of radius in the sawflies, are merely cross veins between the radial

sector and media. Similarly, a comparison of the median and cubital veins in Figs. 66 and 65 would suggest a different interpretation of these veins in the sawflies than the one usually accepted. The venation of certain Psocids (Fig. 40) is very suggestive of that of certain Neuroptera (compare Fig. 40 with Fig. 51; Fig. 31 with Fig. 28, etc.) and Coleoptera, as is also true of certain Homoptera. From the foregoing, it should be quite evident that the lines of descent of the Psocids and their allies the Homoptera, parallel the lines of descent of the insects descended from Neuroptera-like forbears, quite closely, and the forms allied to the Psocids were probably derived from a common source with the Neuropteroid insects (i. e. from Protorthoptera-like forbears.)

I have grouped the Neuroptera, Coleoptera, Strepsiptera, Hymenoptera, Mecoptera, Diptera, Siphonaptera, Trichoptera and Lepidoptera into a superorder called the "Panneuroptera," which corresponds to the Holometabola, or to the Endopterygota of various investigators, and I have here retained the term Panneuroptera merely for the sake of a uniform method of designating the superorders in general. Although the body structures of the adult Coleoptera and Hymenoptera are somewhat more primitive than those of the Neuroptera in general, the Neuroptera have nevertheless retained the wings in a condition more closely approximating the original state for the superorder as a whole, and since the members of the superorder Panneuroptera were all evidently derived from the same (or nearly the same) source, the venation of the Neuroptera may be used to illustrate the origin of the members of the superorder indicated by a study of their wings—which are the only features sufficiently well preserved to compare the structures of their fossil precursors with those of their modern descendants. The wing of the Neuropteron shown in Fig. 53 is strikingly like that of the Palaeodictyopteron shown in Fig. 56, and the ancestors of the Neuroptera were undoubtedly like the Palaeodictyoptera in many respects—but this is not the whole story, since the Neuropteron shown in Fig. 20, for example, exhibits many Protoblattid and Protorthopteran features (compare it with Figs. 11, 15, 19, etc., or Fig. 53 with 55, etc.) which cannot be passed over in silence. The only logical explanation for this dual resemblance in fundamental details, is that the line of development of the Protorthoptera-Protoblattida began to diverge from that of the Palaeodictyoptera, as both emerged from their common ancestral group, which in turn was derived from ancestors which combined in themselves the primitive characters of the Palaeodictyoptera, Protodonata, etc. Not only did the Neuroptera arise at the point where the Protoblattida-Protorthoptera began to diverge from the Palaeodictyoptera, but the ancestors of the Isoptera doubtless also arose at or very near this same point (as is also true of the origin of the lines of development of several other forms, such as the Plecoptera, the Megasecoptera, and probably the Synarmogoida, and even the common ancestors of the Hemiptera-like forms) and this doubtless accounts for the fact that the neuration of such a Neuropteron as the one shown in Fig. 16 resembles that of the Isopteron shown in Fig. 12 so closely (if the form in question is really a Neuropteron as Handlirsch and others claim) since all of these have inherited many genes, determinants or factors from a common source, and this causes their lines of development to parallel each other very closely. Whether this explanation is valid or not, the fact

remains that the lines of development of the Neuroptera and their immediate relatives very closely parallel those of such insects as the Protorthoptera, which were descended from the common Protoblattid-Protorthopteran stock, and the explanation given above is as logical as any, since it takes all of the known facts of comparative anatomy into consideration, and none of these facts would militate against this view.

The Dermaptera were apparently descended from the common Protorthopteran-Protoblattid stem, and their line of development parallels that of the Protorthoptera and the Orthoptera remarkably closely. Similarly, the wings of certain Coleoptera are strongly suggestive of those of certain Protorthoptera (e. g. *Probnis speciosa*). I do not find much support, however, in the study of the known types of wings in the two groups for my contention that the Coleoptera and Dermaptera are very closely related (which is based upon a comparison of the general structures of the body), although I feel certain that the relationship between the Coleoptera and the Dermaptera is much more intimate and direct than through the intermediation of their mutual relationship to the Orthoptera and the Protorthoptera. The larvae of the Coleoptera are so like those of the Neuroptera that I have been unable to find any character which will unfailingly distinguish between the two in every case, and the venation of the Coleoptera (fig. 72) is certainly in harmony with the view that the Coleoptera are extremely closely related to the Neuroptera* (fig. 69) —and the usually accepted view that the Holometabola are a natural assemblage is apparently correct. Since the Coleoptera are the next of kin to the Neuroptera and Hymenoptera, the line of development of the Coleoptera (which branched off at the base of the common Holometabolous stem), like that of the Neuroptera, should arise at the point where the line of development of the Protorthoptera-Protoblattida began to diverge from that of the Palaeodictyoptera, but I have not been able to find any Palaeodictyoptera which approach the Coleoptera remarkably closely in their wing venation, and the line of development of the Coleoptera must apparently be regarded as paralleling that of the descendants of the original Protorthopteran-Protoblattid stock on the one side, and the Holometabola on the other—with their closest affinities with the Holometabola in general and the Neuroptera and Hymenoptera in particular. The relationship of the Coleoptera to the Psocids and Homoptera, or to the Plecoptera and Embiids, is not readily apparent from a comparison of the wings available for study (although such Psocids as *Sphaeropsocus kuenowi*, for example, resemble the Coleoptera in some respects) and the relationship of the Coleoptera to these forms (and to the Blattids and Isoptera as well) can be more profitably discussed with other features than the wing veins.

The resemblance between the wings of the Hymenoptera and the Psocids and Homoptera (compare Figs. 66 and 65) has already been discussed (as has also the resemblance between the wings of certain Neuroptera and Psocids), but the closest affinities of the Hymenoptera as indicated by their wing venation

*Since the foregoing was written, Dr. Forbes has shown me some of his figures of Coleopterous venation which very clearly indicate a close relationship between the Coleoptera and the Neuroptera, and he also called my attention to the fact that Fig. 72 which was based upon a figure by Handlirsch, does not accurately represent the condition of the cross veins etc., in *Omma*.

(Figs. 66 and 67) in addition to other features, lie with the Neuroptera (Figs. 69 and 51) and Coleoptera (fig. 72). The evidence of the venation etc., might therefore be taken to indicate that the Hymenoptera, with the Neuroptera and Coleoptera, arose from ancestors whose lines of descent sprang from the point where the common Protorthopteran-Protoblattid stem began to diverge from the Palaeodictyoptera (although no Palaeodictyopterous types which approach the Hymenoptera very closely have yet been found—though the Palaeodictyoptera approach the Hymenoptera's near relatives, the Neuroptera, very closely), and the line of descent of the Hymenoptera parallels that of the Psocids and other forms descended from the common Protorthopteran-Protoblattid stock on the one side, and the Holometabolous types on the other—with their closest affinities with the Holometabola in general, and the Neuroptera and Coleoptera* in particular. The Coleoptera, Neuroptera and Hymenoptera appear to be the most primitive representatives of the Holometabola, and of these, the Coleoptera are a rather aberrant group not as closely related to the higher Holometabola as the Neuroptera and Hymenoptera are, in certain respects. The ovipositor of such Hymenoptera as *Xyela* is astonishingly like those of the Neuropteron *Raphidia*, but the genitalia of male sawflies are extremely like those of male Mecoptera and Diptera (and somewhat less like those of male Trichoptera and Lepidoptera). The Hymenoptera are a cerci-bearing group, while the Neuroptera are not, and the larvae of sawflies are rather more suggestive of those of the Trichoptera and Mecoptera which are cerci-bearing groups, so that in these and certain other particulars, the Hymenoptera appear to lead to the Mecopteroid Holometabola (i. e. the Mecoptera, Diptera, Siphonaptera, Trichoptera and Lepidoptera), but on the whole, I am somewhat more inclined to regard the Neuroptera as slightly nearer the precursors of the Mecopteroid Holometabola than the Hymenoptera are. The venation of the wings of certain Homoptera is extremely like that of certain Hymenoptera (as has been mentioned before) and the ovipositor and terminal segments of a Cicada are extremely like those of the Hymenopteron *Sirex*, for example; similarly, the wings of the Psocids are very like those of certain sawflies (as was mentioned before) and the general characters of the Psocids are very suggestive of affinities with the sawflies (and their relatives the Neuroptera). There are also resemblances between the Hymenoptera and the Embiids (with their relatives the Plecoptera); and the Blattids, and their relatives the Isoptera, are apparently extremely like the ancestors of the Hymenoptera. How can we account for this complicated interrelationship indicated by many features of the body, and supported by the evidence of the wing-venation as well? The only satisfactory answer so far as I can see, is to admit that all of these forms arose from ancestors occupying a position at or near the point where the common Protorthopteran-Protoblattid stem began to diverge from the Palaeodictyoptera. This view would be supported by the evidence of the wing-venation, and would be in harmony with a great number of facts which cannot be explained on any other grounds, so that in the absence of any

*The head capsule, neck plates, terga, ovipositor, etc., of certain Hymenoptera are astonishingly like those of certain Neuroptera, while the mouthparts, male genitalia, etc., of the Hymenoptera are more like those of the Coleoptera, and the same is true to some extent, of the wings.

known facts which would tend to controvert it, I feel that we are safe in adopting this view.

As was mentioned above, the Mecopteroid Holometabola (i. e. the Mecoptera, Diptera, Siphonaptera, Trichoptera and Lepidoptera) are slightly more closely related to each other than they are to the Neuropteroid Holometabola (i. e. the Hymenoptera, Neuroptera and Coleoptera), and their closest affinities are possibly with the Hymenoptera and Neuroptera, while the Coleoptera are slightly further removed from them in many anatomical features. Tillyard, 1919, seems to be inclined to regard the Mecoptera as the nearest living representatives of the types ancestral to the Holometabola in general, but from a study of the general anatomy of the forms in question, I am more inclined to regard the Coleoptera, Neuroptera and even the Hymenoptera, as more primitive (anatomically) than any Mecoptera I have studied, although everyone who has gone into the matter at all deeply will readily admit that the Mecoptera have remained as primitive as any of the *higher* Holometabola (i. e. the Diptera, Lepidoptera, Trichoptera, etc.) in most of their external features at any rate.

Tillyard, 1919, would derive the primitive Lepidopterous venation shown in Fig. 54 and the primitive Trichopterous venation shown in Fig. 37, from that of the insect shown in Fig. 52, which he calls a "Paramecopteron"; and he would derive the primitive Dipterous venation shown in Fig. 61, from that of the insect shown in Fig. 60, which he calls a "Paratrichopteron." If the "Paramecoptera" and "Paratrichoptera" of Tillyard actually represent distinct orders (which I seriously doubt) it would be preferable to call the insect shown in Fig. 60 a "Paramecopteron" (instead of a "Paratrichopteron") since its venation is so nearly identical with that of other Mecoptera (such for example as the one shown in Fig. 57) that it does not seem worth while to place it in a distinct order from the Mecoptera, especially since the wings are the only anatomical features known. Similarly, it would be preferable to call the insect shown in Fig. 52 a "Paratrichopteron" (instead of a "Paramecopteron") if it is to be considered as representing a distinct order, since its venation parallels that of the Trichopteron shown in Fig. 37, for example. The insect shown in Fig. 52, however, is so much like the insects which Tillyard calls "Protomecoptera" and the primitive Mecopterous types, that I am inclined to regard it also as a primitive representative of the order Mecoptera. If the view that the so-called "Paramecoptera" and "Paratrichoptera" are merely types of Mecoptera is correct, Tillyard's derivation of the Lepidoptera, Trichoptera, and Diptera is quite in accord with the views of others who have also derived the Lepidoptera, Trichoptera and Diptera from Mecopterous, or Mecoptera-like forbears. I cannot help but feel, however, that the ancestors of the Trichoptera, Lepidoptera, Diptera, etc., were not pure Mecoptera alone, but that the ancestors of some of these at least, were more of the nature of the common ancestors of the Mecoptera and Neuroptera (with the Hymenoptera.) Thus, for example, the primitive type of Lepidopterous wing shown in Fig. 54 might very readily be derived from a type of wing essentially like that of the Neuropteron shown in Fig. 51 (and many features of the body in general would bear out this assumption), and certain features of the Diptera, for example, point to a very close relationship between them and the Neuroptera (with the Hymenoptera) as well as the Mecoptera, and many

other facts would indicate that the ancestors of the higher Holometabola were pre-Mecopterous forms combining in themselves Mecopterous, Hymenopterous, and Neuropterous features, rather than that the ancestors of the higher Holometabola were simple Mecoptera. Insects which have retained certain anatomical features in a primitive condition are frequently fairly highly specialized in other anatomical features, and until more is known of the general anatomy of *Belmontia*, it would be unwise to attempt to derive all of the higher Holometabola from the insect whose wing is shown in Fig. 52, especially since a study of the body in general (e. g. head and mouthparts of Micropterygid Lepidoptera, etc.) would point to an ancestry for many of the higher Holometabola in forms which are fundamentally more primitive than the Mecoptera (to which group I believe that the insect shown in Fig. 52 belongs.) The line of development of the Diptera parallels that of the Mecoptera remarkably closely, and the two apparently merge as we trace them back to a common source, and in the same way, the line of development of the Lepidoptera parallels that of the Trichoptera remarkably closely, and these two lines of descent also appear to merge as we trace them back to their common ancestry. The lines of descent of the higher Holometabola mentioned above, parallel each other extremely closely, and as we trace them all back to their common source, they are joined by the lines of descent of the Hymenoptera, Neuroptera, etc., and all of these apparently lead back to ancestors occupying a position at or near the point where the common stem of the Protorthoptera and Protoblattida began to diverge from the Palaeodictyoptera. Since the lines of development of the Psocids and Homoptera arose at the same point, both of these groups could readily exhibit characters in common with the Lepidoptera and Trichoptera, having inherited the same tendencies from their common ancestry—and the Protorthoptera have apparently retained more of the characters of this common ancestry than any other group of insects. It would be possible to group the higher Holometabola (i. e. the Mecoptera, Diptera, Lepidoptera, Trichoptera, etc.) in a superorder (Panmecoptera) distinct from the lower representatives of the Holometabola, but it is preferable to group them all in a single Holometabolous group (Panneuroptera) including the Neuroptera, Coleoptera, etc., as well.

The Strepsiptera are a type of Holometabolous insects whose affinities are rather difficult to determine, although the usual view that they are closely related to the Coleoptera is doubtless correct. There are a few points of resemblance between the wings of the Strepsiptera and those of certain Trichoptera, as may be seen by comparing Fig. 74 with Fig. 73, and in their general anatomy they also exhibit some Hymenopteroid features. Many features of the body (particularly of the abdominal region) of the Hemipteroid insects are extremely suggestive of a relationship to the Strepsiptera, and the wing of the Hemipteroid insects shown in Fig. 73 resembles that of the Strepsipteron shown in Fig. 74 in some respects, while the venation of the Hemipteroid insect shown in Fig. 71 is even more similar to the Strepsipteron shown in Fig. 74. The Psocids also approach the Strepsiptera in certain features. The venation of the Coleopterous wing shown in Fig. 70 is somewhat suggestive of the Strepsiptera (Fig. 74), but the resemblance is not very striking, and the relationship between the Strepsiptera and the Coleoptera is better illustrated by the character of the larvae, and cer-

tain features of the adult anatomy. The wing of the modified descendant of the Protorthopteran-Protoblattid stem shown in Fig. 48 exhibits certain features suggestive of a relationship to the Strepsiptera (Fig. 74), but it is quite possible that any resemblance between the venation of the Strepsiptera and Dermaptera is due to their mutual relationship to the Coleoptera—for I still believe that the Coleoptera are closely related to the Dermaptera as well as to the Neuroptera, since they are anatomically intermediate between the two in their general body structures, although the wings available for comparison do not show this very strikingly. It is very probable that the line of development of the Strepsiptera branched off near the base of the Coleopteron stem, and took over in its line of development certain features inherited from the ancestors of the Coleoptera, which occupied a position close to the common stem of the Protorthoptera and Protoblattids, and were therefore related to the Dermaptera also, since these branched off from the common Protorthopteran stock at the point where the line of development of the Coleoptera arose. Any resemblance between the Strepsiptera and the Hemipteroid insects, is possibly due to the inheritance of common factors from their forbears in or near the common Protorthopteran-Protorblattid stock from which they all arose, although the resemblance between the Strepsiptera and Trichoptera is apparently due to a more direct connection than through the intermediation of the Protorthopteroid forms.

The foregoing facts may be briefly summarized as follows. Of the higher insects, the Mecoptera, Diptera, Siphonaptera, Trichoptera and Lepidoptera are extremely closely related, as are the Neuroptera, Coleoptera (with the Strepsiptera?), and Hymenoptera, and all of these insects form a natural group of Neuropteroid insects comprising the superorder *Panneuroptera* (also called Sialomorpha or Sialoformia) corresponding to the Holometabola or Endopterygota of entomologists in general.) Of the remaining higher insects, the Psocids (Parahomoptera), which are here regarded as including the Zoraptera as a suborder or superfamily of the Psocids, the Mallophaga (Lipoptera), and Pediculids (Ellipoptera), are quite closely related, and the Hemiptera, with the Homoptera, are quite closely related to the Thysanoptera, and all of these have been grouped in a Hemipteroid or Psocid superorder called the *Panhomoptera* (also called the Psocomorpha or Psociformia). The lines of development of these Neuropteroid and Psocid superorders parallel one another so closely (due to the inheritance of many factors in common from their forbears, which occupied a position intermediate between the Protoblattid-Protorthopteran stock and the Palaeodictyoptera) that it has seemed advisable to group them all in a larger subdivision of winged insects called the "*Neuropteradelphia*," which comprises all of the so-called higher insects. In most of these "higher" insects, the fore wings are larger than the hind ones, and most of them exhibit no marked tendency toward development of an anal fan. Wings held along abdomen when at rest.

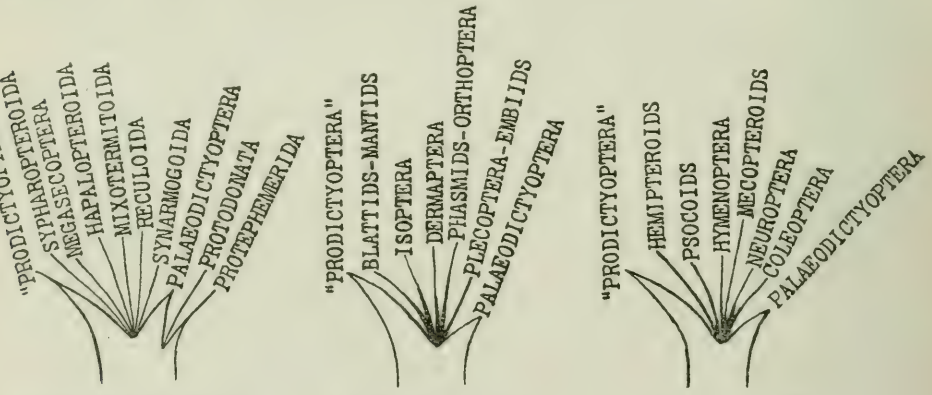
The Blattids (Palaeoptera) and Mantids (Eudictyoptera) are so closely related that they are placed in a single order called the "Dictyoptera" (a term originally applied to the Neuroptera and Odonata) by some recent investigators, and it is largely a matter of personal preference whether they are divided into two orders, or are grouped into one, although if their immediate relatives, the Isoptera, are regarded as a distinct order, they also may be regarded as represent-

ing two distinct orders. The Blattids, Mantids, and Isoptera have been grouped into a Blattoid superorder called the *Panisoptera* (Blattomorpha or Blattiformia), and the Protoblattids (Propalaeoptera) are also placed in this superorder provisionally. The saltatorial Orthoptera (with which the Grylloblattids may be included) are extremely closely related to the Phasmids (Cheleutoptera), and, with the Dermaptera, these three types have been grouped into an Orthopteroid superorder called *Panorthoptera* (Gryllomorpha, or Grylliformia.) The Protorthoptera are so closely related to the Orthoptera, that they might also be included in this superorder. If the Protorthoptera are grouped with the members of the Orthopteroid superorder, and the Protoblattids are grouped with the Blattoid superorder, it is evident that the lines of development of the lowest representatives of the two superorders (i. e. the Protoblattids and Protorthoptera) quickly merge as we trace their lines of descent a little further back, and this might be taken to indicate that it is preferable to combine the two superorders into a single Orthopteroid superorder (Panorthoptera.) The Plecoptera and Embiids (Platyptera) are so closely related that they have been grouped in a Plecopteroid superorder called the *Panplecoptera* (Perlomorpha or Perliformia), and the fossil Hadentomoids (Proplatyptera) might also be grouped in this superorder, but it is preferable to wait until more is known of these fossil forms before attempting to determine definitely where to place them. The Blattoid, Orthopteroid and Plecopteroid superorders are so closely related that it is advisable to group them into a division of winged insects called *"Orthopteradelphia."* In the members of this group, the fore wings are usually smaller than the hind wings. There is a tendency toward development of an anal fan, and the wings are capable of being folded along the abdomen.

The Ephemerida (Archiptera or Plectoptera) have preserved in their "larval" stages, certain features which indicate that they are among the most primitive of living Pterygota, and with the Odonata (Pseudoneuroptera or Paraneuroptera) they constitute a primitive group of insects which branched off from the Pterygotan stem at an early period, to follow their own paths of specialization. Although the Ephemerids are not as closely related to the Odonata as might be expected from certain resemblances to the Thysanoura, which both exhibit, the Ephemerids and Odonata may be grouped in the Ephemeroid superorder *Panarchiptera* (Ephemeromorpha or Ephemeriformia), for the sake of convenience. The Protodonata would also be included in this superorder, since they appear to be merely primitive Odonata, hardly worthy of ordinal rank. The Protephemerida (Protarchiptera) are so closely related to the Ephemerids that they might possibly be placed in the same superorder with them, but it is preferable to wait until more is known of the fossil forms before attempting to group them definitely. The Palaeodictyoptera were formerly placed in the Ephemeroid superorder, but it is preferable to place them in a Palaeodictyopteroid superorder (Panpalaeodictyoptera) which would probably also include the Synarmogoida etc., but so little is known of the fossil forms, that much more investigation is needed before we are able to group them definitely. The Ephemeroid superorder and the Palaeodictyopteroid superorder constitute the division of winged insects called *"Archipteradelphia."* The wings of the members of this division tend to remain subequal in size, and are usually incapable of being

folded along the body (i. e. are held out from the body when at rest.) True anal fan lacking in practically all of these insects.

If we were able to make a detailed study of the immediate precursors (or even the earliest representatives) of the various orders of living insects, they would doubtless exhibit so many features in common, that it would be extremely difficult to separate them into well defined superorders, and even when we are dealing with living insects alone, the persistence of "synthetic" types, or forms annectant between several orders, makes it very difficult to determine the group with which the forms in question have their closest affinities. The wings of some of the fossil forms sufficiently well preserved for study, combine in themselves so many features common to a large number of recent orders, that when these fossils are included in any grouping of insects into superorders or larger divisions, these groupings are found to intergrade because of the fact that some of these intermediate fossil forms might as readily be included in one group as another, and it is only when we restrict our consideration to living forms alone, that the superorders and divisions are at all clearly defined. In fact, it would be entirely possible to use a different method of grouping insects than the one proposed above, but the grouping of winged insects into the higher orders (Neuropteradelphia), lower orders (Orthopteradelphia) and archaic forms (Archipteradelphia) emphasizes the fact that the lines of development of some "hang together for a longer time" than others do, in "travelling along the road to specialization," and I have attempted to give expression to the same idea in grouping the members of these divisions into superorders.



The appended diagrams will serve to illustrate graphically the lines of descent of the principal orders of winged insects, which have been represented in three groups for the sake of simplicity, since if all were given in one figure, there would result a confusing crossing of lines, since the various lines of descent converge from three different directions forming a "bush-like" figure represented as though drawn "in three dimensions," and it is preferable to simplify such a figure by giving its component parts in three sections, as represented in the diagrams. The "Prodictyoptera" are the common ancestors (or common stem) of the Protorthoptera and Protoblattids; the designation "Prodictyoptera" is used for the sake of brevity in the diagrams.

ABBREVIATIONS.

C. ...Costal vein; Sc. ...Subcostal vein; Rs. ...Radial sector; R_1, R_2, R_3, R_4, and R_5..Branches of Radial Vein; M_1, M_2, M_3 and M_4..Branches of Median vein; Cu. ...Cubital veins; A. ...Anal veins.

EXPLANATION OF PLATES.

Fig. 1. Forewing of fossil Megasecopteron *Corydaloides scudderi*, redrawn from Handlirsch, 1908.

Fig. 2. Forewing of fossil Orthopteron *Locustopsis elegans*, redrawn from Handlirsch, 1908.

Fig. 3. Forewing of fossil Synarmogoidan *Synarmoge ferrarii*, redrawn from Handlirsch, 1920.

Fig. 4. Forewing of fossil Sypharopteroidan *Sypharoptera pneuma*, redrawn from Handlirsch, 1920.

Fig. 5. Forewing of fossil Protorthopteron (?) *Elcanopsis sydenienis*, redrawn from Tillyard, 1918.

Fig. 6. Forewing of Protorthopteron *Limopterum ornatum*, redrawn from Handlirsch, 1920.

Fig. 7. Forewing of fossil Reculoidan *Recula parva*, redrawn from Handlirsch, 1920.

Fig. 8. Forewing of Plecopteron *Isogenus* sp., redrawn from Comstock, 1918.

Fig. 9. Forewing of fossil Hapalopteroidan *Hapaloptera gracilis*, redrawn from Handlirsch, 1920.

Fig. 10. Forewing of fossil Mantid *Petromantis rossica*, redrawn from Handlirsch, 1908.

Fig. 11. Forewing of fossil Protorthopteron *Gyrophlebia longicollis*, redrawn from Handlirsch, 1920.

Fig. 12. Forewing of Isopteron *Hodotermes mossambicus* redrawn from Handlirsch, 1908.

Fig. 13. Forewing of fossil Mixotermitoidan *Geroneura wilsoni*, redrawn from Handlirsch, 1908.

Fig. 14. Forewing of fossil Mantid *Palaeomantis schmidti*, redrawn from Handlirsch, 1920.

Fig. 15. Forewing of fossil Protoblattid *Protophasma dumasi*, redrawn from Handlirsch, 1920.

Fig. 16. Forewing of fossil Neuropteron (?) *Gigantotermes excelsus*, redrawn from Handlirsch, 1908.

Fig. 17. Forewing of fossil Mixotermitoidan *Mixotermes ligauensis*, redrawn from Handlirsch, 1908.

Fig. 18. Forewing of Embiid *Donaconethis abyssinica*, redrawn from Comstock, 1918.

Fig. 19. Forewing of fossil Protorthopteron *Spaniodera ambulans*, redrawn from Handlirsch, 1920.

Fig. 20. Forewing of fossil Neuropteron *Nymphites braueri*, redrawn from Handlirsch, 1920.

Fig. 21. Forewing of fossil Hadentomoidan *Hadentomum americanum*, redrawn from Handlirsch, 1920.

Fig. 22. Forewing of Plecopteron *Zelandobius confusus*, redrawn from Tillyard.

Fig. 23. Hindwing of fossil Protoblattid *Eucaenus ovalis*, redrawn from Handlirsch, 1920.
Fig. 24. Hindwing of fossil Protoblattid *Protophasma dumasi*, redrawn from Handlirsch.
Fig. 25. Forewing of Trichopteron *Beracodes minuta*, redrawn from Ulmer, 1907.
Fig. 26. Hindwing of Isopteron *Mastotermes darwiniensis*, redrawn from Comstock, 1918.
Fig. 27. Hindwing of Mantid *Metallactra splendida*, redrawn from Handlirsch, 1908.
Fig. 28. Forewing of Neuropteron *Coniocompsa vesiculigera*, redrawn from Enderlein, 1908.
Fig. 29. Hindwing of fossil Protorthopteron *Sthenaropoda fischeri*, redrawn from Handlirsch, 1920.
Fig. 30. Forewing of fossil Palaeodictyopteron *Homothetus fossilis*, redrawn from Handlirsch, 1908.
Fig. 31. Forewing of Psocid *Archipsocus brazilianus*, redrawn from Enderlein.
Fig. 32. Forewing of Psocid *Amphientomum paradoxum*, redrawn from Tillyard, 1918.
Fig. 33. Forewing of fossil Thysanopteron *Palaeothrips fossilis*, redrawn from Scudder, 1890.
Fig. 34. Forewing of fossil Protorthopteron *Lepium elongatum*, redrawn from Handlirsch, 1920.
Fig. 35. Forewing of Orthopteron *Dionconema ornata*, redrawn from Handlirsch, 1908.
Fig. 36. Forewing of Homopteron *Dictyophora europaea*, redrawn from Handlirsch, 1908.
Fig. 37. Forewing of Trichopteron *Ryacophila*, redrawn from several sources.
Fig. 38. Forewing of Trichopteron *Chaetopteryx villosa*, redrawn from Tillyard, 1919.
Fig. 39. Forewing of Homopteron *Bothriocera prosiamoretti*, redrawn from Metcalf, 1913.
Fig. 40. Forewing of Psocid *Caliopsocus infelix*, redrawn from Enderlein, 1903.
Fig. 41. Forewing of fossil Protohemipteron *Eugereon boeckengi*, redrawn from Handlirsch, 1920.
Fig. 42. Hindwing of Blattid *Periplaneta australasiae*, redrawn from Handlirsch, 1908.
Fig. 43. Hindwing of Blattid *Chorisoneura nigrifrons*, redrawn from Handlirsch, 1908.
Fig. 44. Hindwing of Blattid *Diaphana fieberi*, redrawn from Handlirsch, 1908.
Fig. 45. Hindwing of Orthopteron *Tettix subulata*, redrawn from Handlirsch, 1908.
Fig. 46. Hindwing of Plecopteron *Eusthenia spectabilis*, redrawn from Comstock, 1918.
Fig. 47. Hindwing of Homopteron *Myndus*, redrawn from Metcalf, 1913.
Fig. 48. Hindwing of "an earwig" (Dermapteron) redrawn from Comstock, 1918.
Fig. 49. Hindwing of Phasmid *Xeroderus kirbyi*, redrawn from Handlirsch, 1908.

Fig. 50. Hindwing of fossil Palaeodictyopteron *Lamproptilia grandeuryi*, redrawn from Handlirsch, 1908.

Fig. 51. Forewing of Neuropteron *Austrosialis ignicollis*, redrawn from Tillyard, 1919.

Fig. 52. Forewing of fossil Mecopteron (?) *Belmontia mitchelli*, redrawn from Tillyard, 1919.

Fig. 53. Forewing of Neuropteron *Protohermes davidi*, redrawn from Tillyard, 1919.

Fig. 54. Forewing of Lepidopteron *Eriocrania semipurpurella*, redrawn from Tillyard, 1919.

Fig. 55. Forewing of fossil Blattid *Polyctoblatta calopteryx*, redrawn from Handlirsch, 1908.

Fig. 56. Forewing of fossil Palaeodictyopteron *Fouquea sauvagei*, redrawn from Handlirsch, 1908.

Fig. 57. Hindwing of Mecopteron *Panorpodes carolinensis*, redrawn from Tillyard, 1918.

Fig. 58. Forewing of Homopteron *Hotinus*, redrawn from Handlirsch, 1908.

Fig. 59. Forewing of fossil Blattid *Aisoblatta orenburgensis*, redrawn from Handlirsch, 1908.

Fig. 60. Forewing of fossil Mecopteron *Austropsyche superba*, redrawn from Tillyard, 1919.

Fig. 61. Forewing of Dipteron *Protoplasa fitchii*, redrawn from Tillyard, 1919.

Fig. 62. Forewing of fossil Odonatan *Protagrion audouini*, redrawn from Handlirsch, 1908.

Fig. 63. Forewing of fossil Protephemerid, *Triplosoba pulchella*, redrawn from Handlirsch, 1920.

Fig. 64. Forewing of Blattid *Diaphana fieberi*, redrawn from Handlirsch, 1908.

Fig. 65. Forewing of Psocid *Caecilius*, redrawn from Enderlein, 1903.

Fig. 66. Forewing of Hymenopteron *Xycla julii*, redrawn from Macgillivray, 1906.

Fig. 67. Hindwing of Hymenopteron *Neurotoma fasciata*, redrawn from Macgillivray, 1908.

Fig. 68. Forewing of fossil Homopteron *Mesojassus ipsviciensis*, redrawn from Tillyard, 1920.

Fig. 69. Forewing of Neuropteron *Stenosialis australiensis*, redrawn from Tillyard, 1919.

Fig. 70. Hindwing of Coleoptera *Philonthus*, redrawn from Handlirsch, 1908.

Fig. 71. Forewing of Homopteron *Toxoptera graminum*, redrawn from Patch, 1909.

Fig. 72. Hindwing of Coleopteron *Omma stanleyi*, redrawn from Handlirsch, 1908.

Fig. 73. Hindwing of male Trichopteron *Lepocella punctata*, redrawn from Ulmer, 1907.

Fig. 74. Hindwing of fossil Strepsipteron *Paracenos eberi*, redrawn from Handlirsch.

Fig. 75. Hindwing of Hemipteron *Cyphostethus tristriatus*, redrawn from Handlirsch, 1908.

SOME APPARENTLY UNDESCRIBED NOCTUIDAE (LEPID.)

BY J. MCDUNNOUGH,
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Oncocnemis lepipoloides sp. n.

Head, thorax and primaries gray, lightly sprinkled with black. Primaries with the ordinary lines well-defined, black, single; basal half-line straight from costa to cubitus; t. a. line outwardly oblique, dentate with inwardly directed teeth below cell and in submedian fold; t. p. line, irregularly dentate, well excurved around the cell with a decided inward angulation in the submedian fold; median shade distinct, blackish, strongly oblique below costa, cutting across lower portion of reniform, then parallel and close to t. p. line. Orbicular and reniform improminent, former recumbently oval, outlined only toward base of wing by a dark crescent; reniform moderately large, outlined partially by a fine dark line, open at top and bottom; claviform not present. S. t. line represented by a dark irregular shade, slightly defined outwardly by a pale line. A broken dark terminal line. Fringes smoky brown, cut by paler. Secondaries smoky white, with a broad black-brown terminal band; immediately basad of this band is a fine dark line, forming an outward tooth just before inner margin; a dark lunule at end of cell with traces of a dark line connecting it with inner margin. Beneath smoky gray with well-defined postmedian, curved dark line and small discal dots; traces of dark shade along outer margin. Expanse 32 m.m.

Holotype—1 ♀, Lethbridge, Alta. (Aug. 24) (H. L. Seamans), No. 512, in Canadian National Collection.

This species is astonishingly like *Lepipolys perscripta* in maculation, but after a careful study I believe it distinct from this species. Structurally the front is smooth, whereas in *perscripta* there is often a well-defined frontal tubercle; the spines around the ovipositor seem also decidedly coarser than in *perscripta*. With regard to the maculation, there is none of the light brown colouring found in *perscripta* adjacent to the t. a. and t. p. lines, these lines being single; the t. p. line is more incurved in the fold and the teeth seem hardly as prominent, the claviform is absent, and there is no trace of the arrow marks before the s. t. line, usually visible to a certain extent in *perscripta*. The maculation of the hind wings seems also to differ in the clearness of the postmedian line inside the marginal band. Finally *perscripta*, according to the specimens before me, flies in early spring (Feb.—April), whilst the present species was captured in August.

Oncocnemis youngi sp. n.

Head and palpi brown with black sprinkling; tegulae light brown; thorax purplish gray; abdomen whitish. Primaries fawn colour washed with light brown in median area and purplish gray along outer margin; lines black, single; basal half-line straight; t. a. line thick, slightly outcurved; t. p. line oblique outwardly from costa to vein 5, then incurved forming a sharp angle on this vein, straight from vein 3 to just above inner margin, where it bends slightly inward; orbicular and reniform outlined in black, former small, oval, latter resting with its upper and lower extremities on t. p. line; on costa a dark dash between spots indicates median shade; claviform faintly outlined, narrow; beyond t. p. line wing is evenly purple-gray with a slight pale shading on costa; faint dark broken terminal line;

fringes purplish with ochreous basal line. Secondaries whitish, shaded with smoky brown in outer third, preceded by traces of post-median line. Beneath, primaries shiny fawn colour with a straight dark postmedian line crossing upper half of wing; lower half of wing hyaline white; secondaries hyaline white shaded with fawn along costa and inner margin; a broken curved postmedian line accentuated on the veins and small discal dot. Expanse 38 m.m.

Holotype—1 ♀, Biological station, Departure Bay, B. C. (Aug. 7) (C. H. Young), No. 513, in Canadian National Collection.

Belongs in the *chorda-bakeri* group; the angle in the t. p. line seems characteristic.

Oncocnemis columbia sp. n.

Thorax and primaries deep purple-gray with slight, paler shading on latter beyond t. p. line. On primaries ordinary lines single, black, distinct; basal halfline slightly outcurved, t. a. line thick, especially at costa, well outcurved, with a black loop representing the claviform attached to its centre; t. p. line sinuate, well excurved opposite cell, where it shows very slight angulations on the veins. Orbicular and reniform concolorous, outlined by a black line, along the interior edges of which is some slight, whitish shading; orbicular large, almost round, reniform short and broad, touching the t. p. line with its lower edge; slight traces of an irregular dark s. t. line; a broken black terminal line; fringes dusky. Secondaries white in basal half, smoky outwardly with small dark discal dot and veins outlined in smoky; fringes dark with pale basal line. Beneath, primaries smoky with dark postmedian line on costal half of wing; whitish above inner margin; secondaries white with grey shading along costa and inner margin; a curved, dotted postmedian line and a small discal dot. Expanse 30 m.m.

Holotype—1 ♂, Salmon Arm, B. C., (July 17) (W. R. Buckell), No. 514, in Canadian National Collection.

Belongs in same group as the preceding species.

Trachea pluraloides sp. n.

Head and thorax gray with dark sprinkling. Primaries light ochreous shaded with gray, especially along costa and outer and inner margins. T. a. and t. p. lines obsolete; orbicular oblique, narrowly oval, white-ringed; reniform small, dark-filled, outlined on inner side by a black line followed outwardly by a white line; claviform a faint, narrow, long loop; some gray shading between veins 2-4 in subterminal area; s. t. line distinct, pale, angled below costa with an outward bulge between veins 2-5; terminal area gray-shaded with broken terminal dark line; fringes dusky with pale basal line. Secondaries whitish with veins and some slight terminal shading smoky; fringes pale.

Beneath whitish with smoky sprinkling, small discal dots, broken dark terminal line on both wings and checkered fringes on primaries. Expanse 32 m.m.

Holotype—1 ♀, Lethbridge, Alta. (July 7) (H. L. Seamans), No. 515, in Canadian National Collection.

Paratype—1 ♀, Lethbridge, Alta. (July 15) (E. H. Strickland), in Canadian National Collection.

The species bears an astonishing superficial resemblance to *Euxoa pluralis* Grt. but differs structurally; its position in the genus would be next to *characta* Grt.

Euplexia benesimilis sp. n.

In the Entomologists' Monthly Magazine, 1917, Vol. LIII, p. 157, Mr. W. H. T. Tams calls attention to differences both in maculation and genitalic structure between the European species, *Euplexia lucipara* Linn. and our North American species which has been going under the same name. My own studies on these species fully corroborate Mr. Tams' remarks, and as I believe the male genitalia to be sufficiently different to warrant the supposition that the North American and the European forms are distinct, I propose the above name for the North American species, designating a male specimen, No. 516, in the Canadian National Collection from Ottawa, Ont., as holotype. The excellent plate given with Mr. Tams' article shows clearly the differences between the two species and obviates the necessity for any further description on my part.

Escaria homogena sp. n.

Male antennae lengthily ciliate. Head and thorax pale creamy sprinkled with darker scales; abdomen smooth, ochreous. Primaries an admixture of light olivaceous brown, whitish and smoky shades, the latter predominating in the median area beyond the cell and in the terminal area; t. a. line indistinct, irregular, whitish with a small brown loop representing the claviform attached below the cell; orbicular a small but prominent white oval outlined with black; reniform inconspicuous, partially hidden by dark shading, partly outlined in black; between the two spots on costa an oblique dark shade represents the median shade, and below the orbicular is a quadrate whitish area occupying nearly the entire width of the median area; t. p. line outlined in white, most distinct in lower portion of wing, with two prominent teeth below costa and an irregular bulge outwards below cell, the space between reniform and this bulge being filled with smoky black shading; s. t. line white, strongly angled below apex of wing, then close to outer margin with a prominent "W" mark on veins 3 and 4; apex of wing shaded with whitish, remainder of terminal area smoky; fringes well checkered. Secondaries dull smoky with traces of a paler postmedian band; fringes whitish. Beneath, primaries dull smoky with paler terminal area and strongly checkered fringes; secondaries whitish with large discal lunule and two smoky areas along terminal margin. Expanse 25 m.m.

Holotype—1 ♀, Lethbridge, Alta. (June 28) (W. Carter), No. 517, in the Canadian National Collection.

TWO NEW CANADIAN TABANIDAE (DIPTERA)

BY J. MCDUNNOUGH,

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At the close of the description of *T. illotus* O. S. (1876, Mem. Bost. Soc. Nat. Hist. II, 469) the author mentions several specimens from various points in Canada which differ from typical *illotus* principally in the yellower hair of the face and cheeks, the presence of a denuded subcallus and a browner tinge along the costa of the wings. In 1921 I captured a series of such specimens in very fresh condition in a muskeg at Nordegg, Alberta; I also have before me a number of similar specimens from various localities in Manitoba, Alberta and Northern Ontario. As the above mentioned points of distinction from *illotus* seem to be

perfectly constant, it seems reasonable to suppose that we are dealing with a good species which I describe as follows:

Tabanus metabolus sp. n.

♀. Palpi moderately long, slightly swollen at base of second joint, flesh-coloured, with scattered, short black hairs, most numerous toward apex of palpus; face and cheeks gray with pale yellowish hair; front rather broad, gray, with short black hairs, subcallus denuded; antennae with two basal joints gray with numerous black hairs, the third joint moderately excised, basal half red, apical portion black. Thorax black with the usual indistinct pale stripes, sparsely clothed with short yellowish hairs. Abdomen black, dorsally somewhat shiny, the posterior edges of segments with a fringe of yellowish hairs; a centrodorsal series of minute pale triangular patches, of which that on segment three is most distinct; on each side a row of oblique, triangular spots of pale orange color, those on segments two and three being largest and most distinct; on these same two segments the lateral area is more or less tinged with reddish orange (in old and worn specimens decidedly red) and the spots appear as pale streaks on a deeper ground. Venter whitish pollinose, tinged with reddish on basal segments and with last three segments more or less blackish. Legs with femora black, tibiae more or less tinged with deep orange red and with black hairs. Wings hyaline with costa and basal area decidedly tinged with brown and with faint brown shading on the cross veins. Length 12-14 mm.

♂. Front and cheeks gray with short black hairs; palpi blackish, with third joint oval and largely flesh-coloured, with numerous black hairs; other hairs long, yellowish; antennae similar to those of ♀ except that they are much narrower. Abdomen black, with segments two and three broadly orange-brown laterally with paler oblique triangular spots on inner edge of this area; scarcely a trace of spots on other segments. Other features same as in ♀. Length 13 mm.

Holotype—1 ♀, Nordegg, Alta. (June 15), No. 510, in Canadian National Collection.

Allotype—1 ♂, same locality and date, in Canadian National Collection.

Paratypes—16 ♀'s, Nordegg, Alta. (June 12-19), in Canadian National Collection.

There is considerable variation in the size of the species and also in the depth of the orange-coloured spots on the abdomen; in several specimens before me segments two and three show laterally almost as deep a colour as is found in *phaenops* O. S. *Metabolus* is one of the earliest species on the wing and at Nordegg was the only one captured in June; for this reason the reference of the single male to the species seems fairly safe. The range is across the entire continent from Labrador to Alaska.

Tabanus laniferus sp. n.

♀. Palpi moderately long, narrow, not swollen at base, black outwardly, reddish on inside, with numerous black hairs; antennae black, third joint only slightly excavated; face and cheeks grayish-black with black hairs and a fringe of long yellowish hairs around lower margin; front wide, subcallus not denuded, with grayish-black pile and longer black hairs. Thorax and abdomen black, shiny, with black hairs which are longer and thicker than is usual in the group, giving a distinctly hirsute appearance; laterally on the second abdominal segment is a

faint trace of a grayish patch at times tinged with reddish; posterior margin of abdominal segments with slight fringe of pale hairs which at times tend to form minute triangular patches on centro-dorsal line. Legs and venter black. Wings hyaline, the costal cell slightly tinged with brown. Length 13-14 mm.

♂. Similar to ♀ with following exceptions:—The third joint of the palpus is oval, reddish; the fringe of yellowish hair below the face is almost entirely replaced by black hair and the general vestiture is thicker and longer. Length 13 m.m.

Holotype—1 ♀, Banff, Alta. (July 24) (N. Sanson), No. 511. in Canadian National Collection.

Allotype—1 ♂, Same locality and collector, in Canadian National Collection.

Paratypes—6 ♀'s, Banff, Alta. (July 30, Aug. 16) (C. B. Garrett); 5 ♀'s, Jasper Park, Alta. (Sept 15) (F. Johansen); Hector, B. C. (Aug. 26) (R. H. Chapman); Mt. Cheam, B.C. (Aug. 15); Lillooet, B. C. (Aug. 3) (A. W. Phair); Lillooet, B. C. (July 24) (R. C. Treherne).

The species is evidently a mountain inhabitant; it is somewhat similar to *osburni* Hine but can be distinguished by the pilose subcallus, the more hairy vestiture and the lack of the lateral rows of triangular spots on the abdomen which are more or less clearly defined in *osburni*. From *procyon* O. S. it is at once separated by the lack of any dark spots on the wings.

CONCERNING THE FEEDING HABITS OF THE PURSLANE SAWFLY LARVA.

BY W. G. GARLICK,

Vineland Station, Ont.

In the larva of the purslane sawfly (*Schizocerus zabriskiei*, Ashmead) we have an interesting example of an intermediate stage between larvae mining within the tissues of leaves and those feeding externally. A typical leaf mining larva (amongst the sawflies) is usually whitish in color—that is, with no distinctive coloration—and the head and often the thorax is dorso-ventrally flattened in order to accommodate the creature to the mine and to bring the mouth-parts more or less in front of the head. A surface feeder on the other hand is typically of some characteristic coloration and has the thorax and head rounded, the latter bringing the mouth into a ventral position. The purslane sawfly is pale green in colour and the head and thorax are rounded—both characteristics pertaining to a surface feeder—but in this case the larva is a miner. The presence of these characters is simply explained by the fact that owing to the smallness of the purslane leaves a larva cannot obtain sufficient food from a single leaf to reach maturity. When a leaf has been completely mined of its contents, the larva eats its way to the surface and crawls around on the plant till another leaf is found into which a new mine is made, the thickness of the leaves making this possible. Larvae have been observed during their migrations and a great many came under observation while in the act of forming new mines. They are, when their first mine is in a large leaf, about half grown when the first move is made, but it would appear that a single larva may mine from two to four leaves.

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POPULAR AND PRACTICAL ENTOMOLOGY

Tiger Beetle Larvae.

BY CHARLES MACNAMARA,

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The Pilgrims in their Progress through the Interpreter's House were shown, among other excellent things in the Significant Rooms, "a man who could look no way but downwards." So busy was he with a muck-rake gathering together straws and sticks, that he never looked up to see an angel standing close by and holding out a crown for him. In spite of the moral of this story, when I want to find tiger beetle larvae I "look no way but downwards." Crowns, which have always been notoriously uneasy headgear, are much out of fashion at present. And if I did look up, I don't believe I would find that angel on the job anyway. So on my summer walks I usually keep my eyes fixed on every sandy path or bare, loamy place I come to, seeking the burrows of the tiger beetle grubs.

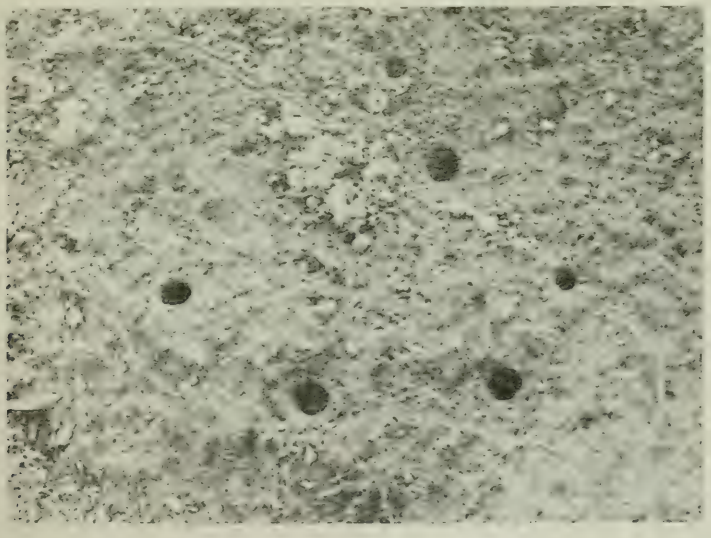

Fig. 1.—Burrows of Tiger beetle larvae.

The burrows look a good deal like ant-holes, but are without the flat cone of excavated earth-particles which always surrounds the mouth of an ant's nest. So clean and smooth is the surface around the opening of a tiger beetle's tunnel that it almost seems as if the insect had accomplished the impossible in beginning at the bottom and digging upwards. The holes may occur singly, or five or six of them an inch or two distant from one another may form a group. In favorable situations there is often a considerable colony of them. Last sum-

mer I found a collection of over 200 burrows in an area of about 10 feet by 20 feet on a sandy farm road in the Township of Fitzroy, County of Carleton, Ontario. This place I called "Tiger Beetle Town," and it was here that I principally studied the habits of the larvae.

You always see the burrows first as empty holes. This is because the exceedingly sharp-eyed occupants saw you coming before you could catch sight of them, and instantly dropped to the bottom of their tunnels, or rather shafts, for the holes go straight downward. But if you sit down, and keeping perfectly still, watch one of the holes, in from one to five minutes the black opening suddenly vanishes. The grub, returning to its steady occupation of lying in wait to seize passing insects, has accurately plugged the hole from within with its flat-topped, sand-covered head, which blends so nicely with the surrounding soil that the opening practically disappears. Raise but a finger and the creature drops again like a shot to the bottom of the shaft, and there is the empty hole once more. A wave of the hand and every tiger beetle larva within thirty feet has disappeared. So incredibly sensitive are they to the slightest movement, that more than once I have scared a larva to the depths merely by turning my eyes to look at him, without any conscious motion of my head. On the other hand they seem to be quite insensible to sound, and whistles and shouts have no effect whatever even on those only a couple of feet away.

Fig. 2.—Head of larva at mouth of burrow.

Probing the holes with a long straw, we find that most of them are 14 inches deep, while an occasional one goes down to 2 feet. In the mild climate of England the larvae burrow only 6 inches into the soil, but in frost-bound Manitoba, Mr. Norman Criddle found the average tunnel to be 66 inches deep with a maximum of 79 inches, a depth bespeaking great energy on the part of both larva and entomologist. The next thing is to secure one of the occupants for examination. There are two ways of catching them. The first, which is possible only in loose soil, is to sit close by a hole with a sharp trowel ready presented, so that when the insect comes to the top, the blade can be suddenly plunged into the earth beneath him, cutting off his retreat. This is a very sporting method, as it calls for long and patient waiting. And it is most exasperating, when, after you have

sat motionless in the hot sun for many minutes, the larva at last comes up, only to drop again in a flash, terrified by the enormous new bulk he caught sight of glowering in his familiar landscape.

The other method of capture is more laborious but more certain. A long straw is inserted in the burrow to mark the course, and then about a foot away a hole is dug with the trowel, going down a little deeper than the bottom of the tunnel. From this a sap is excavated towards the straw, which is carefully uncovered from the top downwards. Near the bottom will be found the squirming, flipping grub we are looking for.

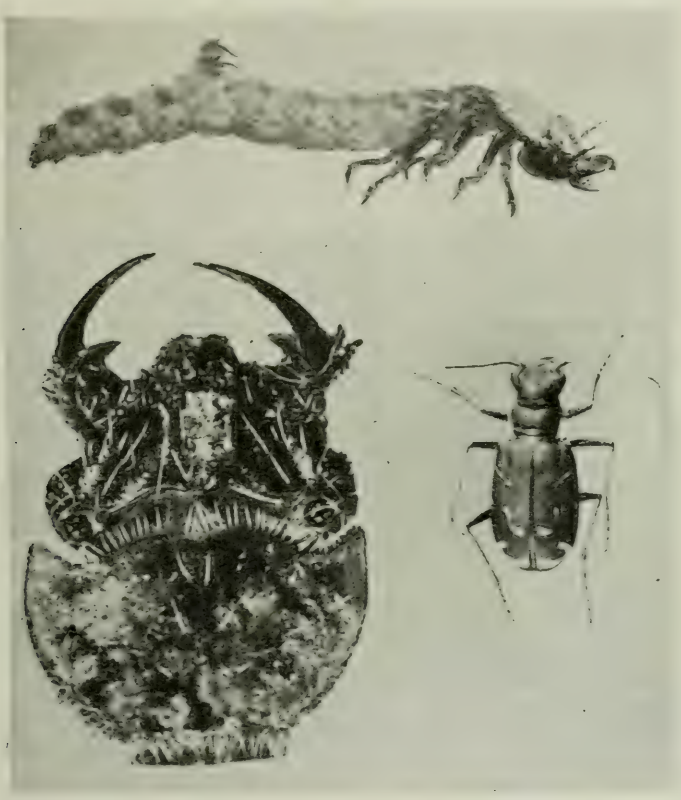

Fig. 3.—Tiger beetle larva, enlarged head of same and adult beetle.

A well-grown specimen is about an inch long with a slim, yellowish-white abdomen and dark-colored thorax and head. It has six thoracic legs, and on its back at the fifth abdominal segment is a curious hump armed with two sharp, curved spines directed forward. This organ is a good example of special development to meet special conditions. When watching at the mouth of its burrow, the creature maintains its position by resting its tail—which is armed with a number of stiff hairs—against one side of the shaft and its hump against the other side with the sharp spines hooked into the wall. In this posture the upper part of the body is crouched down, the flat top of the head coming just level with the surface of the soil. On the approach of its prey, the insect suddenly flings itself part way out of the hole, and seizes the victim with its large jaws.

The curved spines of the dorsal hump, being firmly caught in the earth, prevent it from throwing itself entirely out of the burrow, and no doubt also enable it to resist the pull of any extra large insect it may lay hold on.

When looked at more closely, it is seen that the disc that plugs the mouth of the burrow is not all head. The rear portion of it is a semi-circular plate covering the first dorsal segment of the thorax or pronotum. Situated at the back part of the head, close to the joint between it and the pronotum plate are the insect's four large eyes, two on each side. They are set on the opposite slopes of two little prominences so as to give vision over a complete hemisphere. There are besides two small eyes on what might be called the creature's "cheeks." A large pair of mandibles, sharp-pointed and toothed, are always ready to fasten inexorably on any unwary wanderer.

Torn from their shelter, the grubs are dazed at first. Some of them lie motionless on the sand for half an hour, feigning death. Others, reacting quicker to outrageous fortune, crawl away at once, and soon begin to dig in again. It is noteworthy that the evicted grub never tries to take possession of a ready-made burrow. It seems to realize the kind of welcome it would receive in a brother's tunnel. Specimens brought home for observation purposes were placed in sand-filled jars. If two individuals were put in at the same time, a duel to the death engaged at once. The only way to avoid fatal conflict was to wait until one grub had dug down three or four inches before introducing another. The second arrival would soon begin an excavaction for himself, and when he had disappeared in the sand, another grub could be safely started.

They dig first by loosening the soil with their jaws and scraping it up with their legs. They then push their flat heads under the mass, and reversing their position in the tunnel, raise the earth to the surface on the top of their heads, and jerk the load out of the tunnel, throwing it to a distance of three to six inches from the pit mouth. Although the shaft seems to be a close enough fit for them, the insects are so limber that they can easily bend themselves double and turn around in the closest quarters. Always after a shower of rain, some of the citizens of Tiger Beetle Town found it necessary to dig out soil that had been washed into their burrows, and every minute or so the observer saw a head load of sand flung out. The insect's semi-liquid excrement is also cleaned out in the same manner and thrown well away from the mouth of the burrow.

Nor is their work limited to simple excavating. Where the surface soil is loose they cement the earth around the mouth of the tunnel so as to keep it from crumbling in on them. When necessary they may even continue the shaft above ground by building a wall. A thick, dead mullein leaf, partly embedded in the soil, lay over three of the tunnels in Tiger Beetle Town, and where they came up, the leaf did not quite touch the ground. Now, it is of first importance to the larvae that the mouths of their burrows shall be free of any obstruction. An overlying leaf like this, preventing the approach of prey, would mean death by starvation. They cannot afford to have their lights hidden under either a bushel or a mullein leaf. So these three larvae had built around the mouths of their tunnels little curbs a quarter of an inch high, reaching up to the leaf, which was neatly perforated, thus bringing the tunnel up to the open, game-frequented surface.

It is amusing to drop a tiny white pebble down a shaft and watch results. In a few minutes, up it comes on the tenant's head, and is catapulted out of the hole, and it is not hard to imagine some coarse insect curse. Everything is thrown away as far as possible. It is all very well for that intolerant and churlish nationalist, the ant, with her intense hatred of foreigners, to encumber the approach to her nest with a lot of loose-piled sand. But the tiger beetle is different. He has an unaffected welcome for every visitor, and makes the path to his door as smooth and pleasant as he can.

But with all their deadly preparation and equipment for the capture of prey, it is a mystery to me how they get enough to eat. During a period of six weeks, I watched the inhabitants of Tiger Beetle Town at different times of the day for an aggregate of at least ten solid hours, and in all that time I saw only one very small ant snatched to her doom. On another occasion I noticed on the sand a dragon-fly that seemed to have lost its abdomen. I picked it up to see how the accident might have occurred, and was surprised to find that the abdomen was attached to the insect as usual, but had been pulled down into a tiger-beetle's hole. The dragon-fly's stiff-opened wings had prevented it from being drawn completely into the tunnel, but the larva had evidently held on implacably, and all the dragon-fly's efforts to escape, as shown by the marks of its wings on the sand, had been without avail. However, its steel-blue armor-plate had protected it from serious injury, and it did not seem much damaged when I set it free. These were the only two captures I ever witnessed. The little ant cannot have been more than a light lunch, and the dragon-fly was too tough to eat. But perhaps the larvae have better luck at night. They certainly stay up on the watch all night, as I have ascertained from the dozen individuals I kept in pots of sand at home. No matter what time of the night the light was turned on, there were the heads blocking the holes, and although too small to be seen by the unaided eye, I could picture the steady stare of those immovable black eyes, watching in perpetual hope that something would come along very soon now.

My captives always had excellent appetites for the tiny earth-worms I fed to them. Of course they were instantly scared to the bottom when I came with the food, but they did not stay there very long. Some sense told them that there was a fat worm waiting at the door. The wretched little worm squirmed around aimlessly, as if unable to make up its mind what to do next. But suddenly its mind was made up for it, once and for all, and it was jerked into the hole so swiftly that sight could not follow the procedure. It simply instantaneously disappeared.

None of the larvae I kept at home reached maturity or even pupated. At the end of October they plugged up their tunnels at about the same date that Tiger Beetle Town closed for the season. Digging them up several times during the season to see if there was any change in them—and there was none—caused the death of all but two. Stimulated by the warmth of the house, these opened their tunnels on the fifth day of March, though Tiger Beetle Town began business only on the 7th of May. But they did not remain at the surface, and soon died. The identity of my larvae is therefore in doubt, but as the only tiger beetle imago I have ever found in the vicinity is *Cicindela tranquebarica* Hbst.

(kindly named for me by Mr. Norman Criddle) it seems likely that the larvae belonged to that species.

The life cycle of the tiger beetle lasts from one to three years, according to climate. Prof. V. E. Shelford of the University of Illinois, who has published the best account of the insect's bionomics, says that in the spring the female lays about 50 eggs singly in the sand, and where he studied the insects, a complete generation from egg to egg lasted one year, the adults hibernating in holes in the soil. In Eastern Ontario the life cycle appears to occupy two years, and in Manitoba, Criddle found the period to be three years.

NOTES ON COCCIDAE X. (HEMIPTERA).[1]

BY G. F. FERRIS,
Stanford University, California.

A Review of Green's "The Coccidae of Ceylon."

The appearance of the fifth and final part of "The Coccidae of Ceylon" is a distinct event in the history of the study of the Coccidae, for this work is immeasureably the most admirable treatise dealing with this group that has ever appeared. The first part was issued in 1896 and successive parts have appeared in 1899, 1904, 1909, with the final part in 1922.

The volume composed of these five parts deals with the fauna of a relatively limited area, but it is by no means proportionately limited in its interest to the students of the Coccidae, for many of the included species are practically cosmopolitan. Within its pages there are considered—according to my count—201 species, and in an appendix there are listed 79 more that have been recorded from Ceylon in other publications, a total of 280 for the island. When it is remembered that Ceylon is scarcely 275 miles long and 150 miles wide, these figures become impressive. They are a striking indication of the richness of the tropical scale insect fauna. There are present in this island considerably more than one tenth of all the species of Coccidae that are known!

For the book in general there can be nothing but praise. It represents a tremendous amount of labor, most faithfully performed. But there are a few points concerning which there is some ground for a difference of opinion, and as the volume is likely to stand for a long time as an authoritative source of information, it is perhaps worth while to discuss these. This is also a favorable opportunity for a critique of some of our prevalent methods in the study of the Coccidae. In the course of this discussion I shall consider merely the fifth part of the volume for the long periods that have elapsed since the appearance of the other parts have given ample time for the emendation of these, and in an appendix to Part V, many of these points are considered by the author himself. Furthermore, it is only fairness to say that it is only the long time that Part V has been in press that has prevented the author from making some changes in its content.

The fifth part deals with the subfamilies Eriococcinae, Dactylopiinae, Tachardiinae, Ortheziinae, Margarodinae and Monophlebinae.

The sub-family Eriococcinae is interpreted by Green to include *Eriococcus*, *Gossyparia*, *Ponscolombia*, *Kermes*, *Pseudopulvinaria* and *Rhizococcus*. So far

1—Continued from Canadian Entomologist, Vol. LIV, page 161.

we are in complete agreement, but with the definition of the subfamily and the exclusion from it of certain other genera, I cannot agree. Green's conception of the subfamily seems to be based chiefly upon the presence—usually—of pronounced anal lobes and on the character of the antennae and of the first stage. Such a conception is not adequate, for as Green points out, the anal lobes are not present in certain forms that appear to belong to this group. They are not, however, lacking in *Kermes*, as Green believes, for in several species that I have examined there are well developed and heavily chitinized anal lobes.

The essential characters of the subfamily, as I conceive it, are in part the negative ones of the absence of peculiar structures such as the abdominal spiracles, dorsal ostioles, anal operculum and the like, combined with the positive ones of type of tubular ducts, character of antennae and of the first stage. Interpreted in this fashion, the subfamily easily and naturally includes all the above genera as well as *Cryptococcus* and *Gymnococcus*, which are included by Green in the Dactylopiinae.

Green himself recognizes the difficulties with his subfamily Dactylopiinae, saying that "This rather unwieldy group is at present made to include a large number of genera for which it is difficult to assign any single common character." The reason for this difficulty is simply that the subfamily constituted of these genera is highly unnatural. The majority of the genera form a very compact and easily recognizable group that is sharply limited by the presence of dorsal ostioles. This group will stand as the subfamily Pseudococcinae. The genus *Dactylopius* itself is of somewhat doubtful relationships, but would go better into the Eriococcinae (or Dactylopiinae as it would then be called) and with it should go *Cryptococcus* and *Gymnococcus*. *Halimococcus*, *Capulinia* and *Kuwanina* are of doubtful affinities, but are at least not Pseudococcine. *Apiococcus* remains to be elucidated.

The genus *Geococcus* is interpreted as intermediate between the Eriococcine and Pseudococcine groups. I am unable to see this, for, although it is in some respects a peculiar form, it is in its essentials strictly Pseudococcine. It may be noted that in the case of this and most of the other Pseudococcine genera dealt with by Green the dorsal ostioles are not mentioned. Nevertheless, they are present in all of them, as I can testify from an examination of specimens that have been received through the kindness of Mr. Green.

The genus *Erioides* is structurally very close to the American genus *Pococcus*. In fact, I see no very adequate morphological basis for the separation of the two. The difference in the secretions, however, is quite striking, *Pococcus* having a hard test while the test in *Erioides* is felted.

Some of the species referred by Green to the genus *Phenacoccus* seem scarcely congeneric with the type. *P. insolitus* approaches more nearly *Synacanthococcus* while *iceryoides*, *ornatus* and *mangiferae* come nearer to *Puto*.

Lachnodius humboldtiae is certainly not congeneric with the type of *Lachnodius*. The latter has been re-described by Morrison and Morrison,[2] and there

2—Morrison and Morrison, A Redescription of the Type Species of the Genera of Coccidae Based on Species Originally Described by Maskell. Proc. U. S. Nat. Mus. 60: 44-8; f. 14. (1922)

remains no doubt as to its character. I agree with these authors that it is not Pseudococcine. *L. humboldtiae* on the other hand is certainly Pseudococcine, but its proper disposition must wait upon a more complete study of the group.

Green accepts the three "subfamilies" Ortheziinae, Margarodinae and Monophlebinae. I wish again to emphasize the viewpoint that these divisions are not satisfactory and that these groups are more closely related than such an arrangement indicates.

In his discussion of the Monophlebinae, Green lumps under *Monophlebus* the genera *Drosicha, Llaveia, Tessarobelus, Ortonia, Gueriniella,* (*Guerinia*) and *Monophlebulus*. In this I can not at all follow him. We do not know what the genus *Monophlebus* really is, for the type species was described only from the male and under such circumstances it would seem reasonable to restrict it simply to this species, and to use such generic names as we do know the proper application of for the other species. Furthermore, these genera are certainly not all the same. *Ortonia* is a synonym of *Llaveia* but *Llaveia* is very readily and very justifiably separable from the others named; nor is it at all difficult and certainly it is not unjustifiable to separate *Drosicha* and *Gueriniella*. As to *Monophlebulus* and *Tessarobelus* there may be more doubt, although they too are probably distinct. I shall discuss some of these genera further in another paper in these notes, and shall point out the actual structural differences between them.

So much for these specific criticisms, which are intended not so much as criticisms but as bases for discussion. There remain a few other points that are perhaps worthy of consideration and the criticisms of which are not directed specifically at "The Coccidae of Ceylon" as much as at our work on the Coccidae in general.

One of these has to do with the matter of keys. A key is, in the opinion of the present writer, merely a means of arriving at an identification. On this basis it should be as simple and as carefully constructed as possible. Yet it has been a common practice among students of the Coccidae to base keys upon both sexes and all stages of the species or genera. Thus, Green's keys to the Margarodinae and Monophlebinae are based in part upon the males and first stage, which are not always procurable. Such a practice defeats the purpose of a key, and is especially unfortunate, as it is certainly possible to construct keys that do not use such characters.

Again, there is a need for more accurate study of the dermal structures involved in the production of the secretionary covering—the ducts and pores. It is but recently that any special attention has been paid to these, but I venture to assert that they will become more and more important. The most careful and accurate figures of these should be presented.

Another general criticism has to do with the matter of figures. It has been a very common practice to represent the insect as it is actually seen on the slide, that is, with the structures of both dorsal and ventral sides showing through as if they are on the same side of the body. This is an entirely illogical practice that should be abandoned. The divided drawings that are now being very extensively used have the merit of being clear and logical, even if at first glance they may not appear quite as pleasing to the eye.

THE NORTH AMERICAN SPECIES OF THE GENUS ACRONEURIA (ORDER PLECOPTERA).

BY J. G. NEEDHAM and P. W. CLAASSEN,
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Having nearly completed a monograph of the North American species of the Order Plecoptera, the publication of which will probably be delayed for some time, we propose to publish the results of our studies that are of most immediate importance to other workers on the group in a series of short papers, the first of which is this one on the species of *Acroneuria*. We shall include in these papers only diagnostic characters (mostly in keys to the species), notes on synonymy, and descriptions of new forms, leaving detailed descriptions of known species and illustrations to await the publication of the monograph.

The genus *Acroneuria* includes a number of large species in which the prolonged and upturned 9th ventral segment in the male bears a prominent mid-ventral chitinized percussion disc or hammer, and the genital hooks are developed from upcurving angles of the subanal plates. The tergum of the 10th abdominal segment is undivided. The venation of the wings is copious; the subcosta is long; the fusion of radial sector and median vein in the disc of the hind wing is moderate, the anal area of the hind wing is broad, the branches of the 2nd and 5th anal veins being numerous. In *A. abnormis* Newman, there are numerous crossveins in the wing apex beyond the cord, but in the series of species these gradually disappear, and in some are quite lacking.

Under the genus *Acroneuria* we recognize the following three subgenera: 1. *A.* (*Acroneuria*) Pictet; 2. *A.* (*Eccoptura*) Klapalek; 3. *A.* (*Doroneuria*) subgen. nov.

1. *A.* (*Acroneuria*) Pictet. 1841, Perlides, p. 144. Male, ninth ventral segment prolonged and bearing a round or transversely oval hammer; genital hooks either flat or cylindrical; female, eighth ventral segment either unmodified or produced into subgenital plate.
   Subgenotype. A. (*Acroneuria*) *arenosa* Pictet.

2. *A.* (*Eccoptura*) Klapalek, 1921, Bull. de la Soc. Ent. de Belgique 61:60 Color wholly yellow; no cross veins in the tip of wing beyond the cord; ninth ventral segment of male prolonged and bearing a longitudinally oval hammer; genital hooks cylindrical, pointed and bearing at the base a bunch of hairs; female, eighth ventral segment produced into a bilobed subgenital plate.
   Subgenotype. A. (*Eccoptura*) *xanthenes* Newman.

3. *A.* (*Doroneuria*) subgen. nov. No cross veins in the tip of wing beyond the cord; ninth ventral segment of male prolonged and bearing a longitudinally rectangular hammer; female, eighth ventral segment not produced into a subgenital plate.
   Subgenotype. A. (*Doroneuria*) *theodora* sp. nov.

Among the numerous species described by the older authors, *A. abnormis* appears to be the only one that has been correctly identified by all those who have discussed the genus. The others we found in a confusion that seemed at first to be inextricable. But a restudy of the types and topotypes in American collections,

a comparison of notes made from types in European collections by helpfully minded colleagues, and adequate collections from typical localities, have enabled us to identify all the species of the older authors with some assurance.

The species we recognize as valid may be separated as follows:

ARTIFICIAL KEY TO THE SPECIES OF ACRONEURIA.

1. Fore wings suddenly widened beyond origin of Rs. Color wholly yellow. Female subgenital plate bilobed, the median notch rectangular. Male genital hooks cylindrical, bearing at the base a bunch of hairs; hammer small, longitudinally oval; segments 9 and 10 above with short spines. *xanthenes*

   Fore wings gradually widened to stigma. Color not wholly yellow.....2

2. Second anal vein of hind wing many (about 12) branched, the branches variously anastomosing. Female subgenital plate produced over half of segment 9, the hind margin evenly rounded. Male genital hooks cylindrical, sharp; hammer small, transversely oval; segments 8, 9 and 10 above with short spines.....*arenosa*

   Second anal vein of hind wing 3-6 branched 3

3. Cross veins numerous over the entire area in fore wing beyond the cord; usually a pair of triangular dark spots on head behind the ocelli pointing inward. Female subgenital plate slightly produced, hind margin even. Male genital hooks flat, triangular, sharp; hammer transversely oval; segments 9 and 10 above with short spines.....*abnormis*

   Area beyond the cord in fore wing not entirely filled in with cross veins; no triangular spots on head behind ocelli.....4

4. Head with a blackish spot covering the ocellar triangle; Eastern species...5

   Head usually pale or concolorous above, including the ocellar triangle; (*pacifica* sometimes with black over the ocellar triangle).....8

5. With very few (1-4) cross veins in the area beyond the cord; female subgenital plate evenly rounded or somewhat excavated. Male genital hooks flattened, triangular, sharp; hammer small, transversely oval, segments 9 and 10 above with short spines.....6

   With a larger number of cross veins in the area beyond the cord; female subgenital plate not evenly rounded; male genital hooks long, cylindrical; segments 9 and 10 above with short spines.....7

6. Black spot over ocellar triangle rounded behind; female subgenital plate produced, hind margin either evenly rounded, truncate in the middle, or somewhat excavated.....*lycorias*

   Black spot over ocellar triangle angulate behind; female subgenital plate produced, hind margin angulately emarginate in the middle.....*carolinensis*

7. Subgenital plate of female produced somewhat and bearing two flap-like lobes. These lobes are often found to be laid back over the plate so that the plate appears to be more or less evenly rounded.....*internata*

   Subgenital plate of female produced over about half the length of segment 9, and bearing in the middle a short, declivitous, narrowed portion (♂ unknown) .....*trijuncta*

8. Head and thorax wholly blackish; no extra crossveins beyond the cord. Female subgenital plate not produced, hind margin entire. Male genital hooks

short cylindrical; hammer large, longitudinally rectangular, surface ridged; no spines above on segments 9 and 10.....*theodora*

Head and thorax pale or obscure, never wholly blackish.....9

9. Usually with no crossveins beyond the cord; female subgenital plate not produced, western species.....10

With crossveins beyond the cord; female subgenital plate produced and variously modified.....11

10. Vein Sc weak and indefinite at its tip. Female subgenital plate cut straight across apex. Male genital hooks flat, triangular; hammer large, transversely oval; segments 9 and 10 above with short spines. Expanse of wings 50-70 mm.....*depressa*

Vein Sc stronger and definite at its tips. Female subgenital plate not produced but somewhat emarginate in middle, 9th ventral segment of female with a rounded spot each side. Male genital hooks cylindrical; hammer longitudinally rectangular; no spines above on segments 9 and 10. Expanse of wings 40-55 mm.....*californica*

11. Median longitudinal depressed area between the rugosities of the pronotum wide (about one sixth of width of pronotum). Male genital hooks flat, short and very broadly triangular, as wide as long; hammer transversely oval; female subgenital plate produced, and evenly rounded. Western species.....12

Median longitudinal area of pronotum narrow (about one tenth of width of pronotum); male genital hooks not as wide as long; female subgenital plate variously modified. Eastern species.....13

12 Size large. Expanse of wings 30-50 mm. Female subgenital plate produced over half of segment 9, the hind margin slightly angulate and usually bearing at the apex a squarish, shiny spot.....*pacifica*

Size smaller. Expanse of wings 18-30 mm. Female subgenital plate produced over two thirds of segment 9, the hind margin evenly rounded and not bearing at the apex a shiny spot.....*pumila*

13. Female subgenital plate much produced, either bilobed or bearing a declivitous projection. Male genital hooks cylindrical, segments 9 and 10 above with short spines.....14

Female subgenital plate not much produced, hind margin more or less evenly rounded. Male genital hooks flattened, triangular.....15

14. Female subgenital plate narrow at base and at the apex two-lobed. Male genital hooks cylindrical, slender and usually outcurved, hammer small, almost circular.....*aruda*

Female subgenital plate with a declivitous projection whose hind margin is entire. Male genital hooks more broadly cylindrical and usually straight, hammer larger, transversely oval.....*evoluta*

15. Female subgenital plate somewhat produced, evenly rounded and bearing before the apex a transverse narrow tubercle. Male genital hooks flat, broadly triangular, hammer transversely oval, segments 9 and 10 above without short spines.....*ruralis*

Female subgenital plate somewhat produced, the hind margin slightly angulate, no tubercle before the apex. Male genital hooks flat, narrowly trian-

gular, hammer transversely oval, segments 9 and 10 above with short spines ..... *pennsylvanica*

The following is a list of the North American Species of Acroneuria which are known to us, arranged in the order in which they were described, with synonyms.

1. *Acroneuria xanthenes* Newman, 1838. Ent. Mag. 5:178.

brevicauda Klapalek, 1909. Bull. Internat. Acad. Sci. Boheme, p. 12.

This is the only species of this genus which is wholly pale yellow. It ranges over the Southeastern States. Klapalek's description of *brevicauda* has led us to believe that it is a synonym of *xanthenes*. He gives no figure, and does not include the species in his key to the genus, immediately preceding.

Klapalek's treatment of *xanthenes* both in the paper above cited and in Bull. de la Soc. Ent. de Belgique 61:60, 1921, posthumously published by Lestage, evidences too great haste to describe. In the latter paper he makes *xanthenes* holotype of a new genus *Eccoptura,* based mainly on secondary sexual characters of the male. These are for the most part stated incorrectly.

2. *Acroneuria abnormis* Newman, 1838. Ent. Mag. 5:177.

This is about the only species of this genus described by older authors that has been correctly identified by all later workers on this group. The manuscript name *sonans* (Barnston) Newport is a synonym of *abnormis*. Generally distributed east of the Rocky Mountains.

3. *Acroneuria lycorias* Newman, 1839. Ann. Mag. Nat. Hist. 3:85.

A. navalis Provancher, 1883. Pet. Faun. Can. Neurop. p. 73.
A. riparia Provancher, 1883. Pet. Faun. Can. Neurop. p. 74.
A. excavata Banks, 1908. Trans. Am. Ent. Soc. 34: 256.

Ranges over eastern North America and extends as far as Virginia. There is considerable variation in the subgenital plate of the female. The hind margin is either evenly rounded, truncate at the apex or slightly emarginate. Through the kindness of Canon Huard Provancher's types in the Provincial Museum at Quebec were studied in January 1922 by the senior author, and Banks' and Hagen's types were studied in February, 1922 by the junior author.

4. *Acroneuria arenosa* Pictet, 1841. Perlides, p. 178.

This is the type species of the genus. It ranges over the Eastern States.

A comparison of a large series of topotypes from Pennsylvania with the description and figures of Pictet has enabled us to identify this species beyond doubt. The large number of branches of the second anal vein of the hind wing sets off this species from all others in the genus. Pictet's figure (fig. 2, plate X), though none too well drawn, shows this character.

5. *Acroneuria pennsylvanica* Rambur, 1842. Neurop. p. 456.

Klapalek (Bull. Internat. Acad. Sci. Boheme, p. 8, 1909) has seen the type and rescued this species from syonymy. His figure and description, together with a series of specimens from the type locality, shows that *pennsylvanica* is distinct from *abnormis*. Eastern States.

6. *Acroneuria internata* Walker, 1852. Brit. Mus. Cat. Neurop. p. 152.

7. *Acroneuria trijuncta* Walker, 1852. Brit. Mus. Cat. Neurop. p. 153.

Both these species have long reposed in our lists as synonyms of *A. abnormis*; but Dr. Nathan Banks has studied the types, and the notes and the sketches of them that he has kindly placed at our disposal show that both of them must

be restored. A careful reading of Walker's description will show disagreement with *A. abnormis;* and the secondary sexual characters which Walker did not describe are very different. Though both are eastern species of more than local distribution, neither has been redescribed, and no synonyms have resulted from their long suppression.

8. *Acroneuria arida* Hagen, 1861. Syn. Neur, N. A. p. 18.
valida Banks, 1905. Trans. Am. Ent. Soc. 32: 4.

A study of the type shows this to be a distinct species and not a synonym of *arenosa* as Hagen suggested. Eastern and Southern States.

9. *Acroneuria ruralis* Hagen, 1861. Syn. Neur. N. A. 18.
rupinsulensis Walsh, 1862. Proc. Acad. Nat. Sci. Phil p. 363.
quebecensis Provancher, 1883. Pet. Faun. Can. Neurop, p. 72.
attenuata Banks, 1905. Psyche, 12: 55.

Topotypes of *A rupinsulensis* Walsh from Rock Island, Ill., agreeing exactly with Walsh's very detailed original description were identified by the senior author as of this species, and so indicated in Bull. U. S. Bur. of Fisheries. 36: 274, 1920. Since then the types of Provancher and Banks and the cotypes? of Walsh in the Hagen collection of the Museum of Comparative Zoology, at Cambridge, Mass., have been studied by us, as well as a large number of specimens from many localities. The transverse narrow tubercle before the apex in the female subgenital plate and the absence of spinules on the dorsal abdominal segments in the male are characters which distinguish this species. Of wide distribution East of the Rocky Mountains.

10. *Acroneuria pacifica* Banks, 1900. Trans. Am. Ent. Soc. 26:242.
nigrita Banks, 1904. Trans. Am. Ent. Soc. 30: 98.

A comparison of the types of *pacifica* and *nigrita* proves these to be identical. Both female types have the subgenital plate evenly rounded, with a shiny squarish spot at the apex. Western States.

11 *Acroneuria californica* Banks, 1905. Inverteb. Pacifica 1:87.
? *concolor* Banks, 1908. Trans. Am. Ent. Soc. 34: 255.

The type of *californica* is a female and the type of *concolor* is a male.

They agree in general characteristics and apparently belong together. California.

12. *Acroneuria carolinensis* Banks, 1905. Bull. Am. Mus. Nat. Hist. 30:215.

This species is very similar to *lycorias* and may be only a variety. The black spot over the ocellar triangle is sharply angulate behind, while in *lycorias* it is evenly rounded. Southeastern States.

13 *Acroneuria pumila* Banks, 1906. Can. Ent. 38:335.

Very similar to *pacifica* but much smaller. Western States.

14. *Acroneuria evoluta* Klapalek, 1909. Bull. Internat. Acad. Sci. Boheme. p. 12.

There is considerable variation in the declivitous extension of the subgenital plate of the female, but in general it may be said to have an evenly rounded or slightly truncate hind margin. Central States and Eastward.

15. **Acroneuria depressa** sp. nov.

Length to tip of wings, male 29-32 mm.; female 32-40 mm. Expanse, male 48-50 mm.; female 56-70 mm.

General color light brown. Head wider than prothorax, reddish brown, darker on clypeus and somewhat darker over the ocellar triangle. Ocelli large, with black on the inside; hind ocelli a little closer to each other than to the eyes.

Prothorax wider than long, not narrowed behind, angles rather sharp, rugosities not very strong. Legs yellowish; femora with a black transverse band just before the tip. Wings uniformly subhyaline; veins light brown; no crossveins in the outer field beyond the cord. Tails light brown, thickly clothed with short hairs. The male ninth ventral segment bears a large, transverse, oval smooth hammer, genital hooks flattened, triangular, sharply pointed; segments 9 and 10 above each with many short spines. Female eighth ventral segment unmodified.

Holotype. Female: Yakima R., W. T. Lone Tree. June 30, '82, S. Henshaw.

Allotype. Male and 7 paratypes (5 females and 2 males) all from same locality.

The holotype, allotype and some of the paratypes are in the Entomological Collection of the Museum of Comparative Zoology, Cambridge, Mass., and the other paratypes are in the Entomological Collection, Cornell University, Ithaca, N. Y.

16. **Acroneuria theodora** sp. nov.

Length to tip of wings, male 29-32 mm.; female 32-40 mm. Expanse, male 48-50 mm.; female 56-70 mm.

General color blackish with smoky wings. Head a little wider than prothorax; black over the ocellar triangle and extending laterally to the base of antennae; occiput and area in front of the frontal M-ridge dark brown; frontal ridge and lateral tubercles yellowish; ocelli form an equilateral triangle; hind ocelli closer to each other than to the eyes. Antennae blackish at base, brown towards the tip; prothorax uniformly blackish, wider than long, somewhat narrowed behind; front angles sharp, hind angles rounded; rugosities rather strong. Wings pale yellow at base, beyond uniformly smoky; veins blackish; no crossveins in the outer field beyond the cord. Basal half of abdomen yellowish above, beyond blackish. Tails brown, thickly clothed with short hairs.

Male brachypterous; ninth ventral segment bears a large longitudinally rectangular hammer whose surface is covered with rearward curving ridges; genital hooks cylindrical, short and sharp. Female eighth ventral segment unmodified.

Holotype, female, Yellowstone National Park.

Allotype, male, and 3 females paratypes from the same locality, in the Entomological Collection at Cornell University.

Another female paratype from Big. Hn. Mts., Wyoming, July 18, '96, R. P. Currie, is in the National Museum, Washington, D. C.

VALID NORTH AMERICAN SPECIES OF ACRONEURIA GROUPED ACCORDING TO RELATIONSHIPS.

1. *A.* (*Acroneuria*) *arenosa* Pictet.
2. *A.* (*Acroneuria*) *abnormis* Newman.
3. *A.* (*Acroneuria*) *ruralis* Hagen.
4. *A.* (*Acroneuria*) *pennsylvanica* Rambur.
5. *A.* (*Acroneuria*) *trijuncta* Walker.
6. *A.* (*Acroneuria*) *internata* Walker.
7. *A.* (*Acroneuria*) *arida* Hagen.
8. *A.* (*Acroneuria*) *evoluta* Klapalek.
9. *A.* (*Acroneuria*) *pacifica* Banks.

10. *A.* (*Acroneuria*) *pumila* Banks.
11. *A.* (*Acroneuria*) *lycorias* Newman.
12. *A.* (*Acroneuria*) *carolinensis* Banks.
13. *A.* (*Acroneuria*) *depressa* sp. nov.
14. *A.* (*Eccoptura*) *xanthenes* Newman.
15. *A.* (*Doroneuria*) *theodora* sp. nov.
16. *A.* (*Doroneuria*) *californica* Banks.

NOTES ON CANADIAN DRAGONFLIES FOR THE SEASON 1922.

BY J. MCDUNNOUGH,

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In an effort to build up the Canadian National Collection of Odonata, considerable attention was paid to this group by me and my assistants during the collecting season of 1922. The long spell of fine weather in May and the first half of June was particularly favourable for our work in the vicinity of Ottawa, and dragonflies were found to be much more abundant than usual. Weekly excursions were made to the Mer Bleue, that famous peat bog twelve miles east of Ottawa, the general character of which has already been the subject of an article by Mr. Arthur Gibson (32nd Rep. Ent. Soc. Ont. 1901, p. 110). Visits were also made to some of the smaller lakes on both the Ontario and Quebec sides of the Ottawa River, to suitable marshy spots on the Rideau river, and to some of the numerous brooks in the Gatineau hills situated about nine to twelve miles north of town.

The species mentioned in the following notes constitute in the main new records for the Ottawa district, the majority not being listed in Dr. E. M. Walker's paper (Ottawa Naturalist XXII, 16); the total number of species of this order occurring in the vicinity is now sixty-five.

ZYGOPTERA

Lestes vigilax Hagen. Found quite abundantly in a marshy inlet of the Rideau river by F. P. Ide during the latter half of June and early July.

Lestes inaequalis Walsh. Taken along with the preceding species but apparently quite rare. Only two ♂'s (June 19) and one ♀ (July 21) were captured.

Enallagma antennatum Say. Three ♂'s and one ♀ of this striking species were taken by F. Ide (June 19) in the same spot on the Rideau river as the *Lestes* species.

Engallagma signatum Hagen. Found in numbers flying well out from shore over the lily pads on the Rideau river about 5 miles south of Ottawa by F. Ide (Aug. 6).

ANISOPTERA

Gomphus spicatus Hagen. A long series of this species, including two ♀'s, was taken at MacKay's Lake, Rockcliffe (June 13, 15). It was first recorded by me from this region in 1920 (Can. Ent. LIII, 14).

Gomphus descriptus Banks. A single ♀ was captured by my assistant, Mr. A. Richardson, at Meach Brook, Gatineau Hills, Que., on June 27. We had

hoped to secure a good series, but it was apparently too late in the month for the species.

Gomphus brevis Hagen. Besides the localities given by Dr. Walker, I have taken the species sparingly at McKay's Lake, Rockcliffe.

Gomphus cornutus Tough. Walker records this from the Mer Bleue, but as a matter of fact the species does not fly over the bog, but along the shores of a small, clay-banked creek, called Castor River, that flows through the village of Carlsbad (Eastman's) Springs, about a quarter of a mile from the Mer Bleue. Here we found it plentifully on June 7 and Mr. Richardson also took a single specimen on June 27 at Fairy Lake, Hull, Que.

Ophiogomphus anomalus Harv. A single ♂ of this species was captured by Mr. Richardson near Meach Brook, Que. (June 20) and one ♀ was taken by myself at Wakefield on the Gatineau river (Aug. 7). The determination was kindly made for me by Mr. E. B. Williamson, Bluffton, Ind.; the species is new to Canada.

Dromogomphus spinosus Selys. One specimen was taken, June 5, by F. P. Ide, in the vicinity of the Rideau river, Ottawa South.

Cordulegaster diastatops Selys. One ♂ was taken, June 27, by Mr. Richardson along Meach Brook, Que. It was recorded by Dr. Walker without mention of locality.

Aeshna verticalis Hagen. A single ♂ was taken at the Mer Bleue by F. P. Ide (July 24); the species is rare in the Ottawa district, the only other specimen in the collection from this region having been taken at Queen's Park, Aylmer, Que., by C. B. Hutchings.

Macromia illinoiensis Walsh. Mr. Richardson found this handsome species quite common on Meach Brook, June 27.

Epicordulia princeps Hagen. Recorded by Walker from a fragmentary specimen, no locality; it was not uncommon at Fairy Lake, Hull, Que. (June 29) and was taken on the Rideau river (Black Rapids) as late as August 12.

Tetragoneuria canis McLachlan. This species was quite common both at the Mer Bleue and along Castor River at Eastman's Springs. It is one of the first species on the wing (May 23), and although generally rare was this year much commoner than either *cynosura* or *spinigera,* the latter of which also is found at the Mer Bleue.

Williamsonia lintneri Hagen.* The species has long been known to occur in this region on the strength of two specimens taken by C. H. Young at the Mer Bleue in 1908. Mr. A. Richardson and myself were fortunate enough to secure eight specimens (4 ♂, 4 ♀) on May 23; they were flying among the small spruce trees situated close to a sphagnum bog, and as several were tenerals, it is probable that the nymphs were breeding in the near-by pools. The mature adults are difficult to see, as they have the habit of sitting with expanded wings on the spruce trunks, darting out at intervals to capture a mosquito. By the end of May the species had disappeared.

Somatochlora franklini Selys. We first met with this species at the Mer

*—Since writing the above Mr. Williamson to whom our material was submitted informs me that the species is not the true *lintneri* but a new species of *Williamsonia* which he purposes to describe shortly.

Bleue on May 23 when several teneral specimens were taken flying along with *W. lintneri*. Two weeks later adults were fairly common about 11 a.m., flying close to the ground over bare areas containing scattered dead dwarf larches, on the branches of which they would occasionally alight.

Somatochlora kennedyi Walker. Two ♂ specimens were taken (June 7) along with the preceding species, from which they can with difficulty be distinguished on the wing.

Somatochlora walshi Scudder. Two ♂'s and one ♀ were captured on July 24 by Messrs. Richardson and Ide at the Mer Bleue around the same sphagnum bog where *W. lintneri* occurred earlier in the season.

Erythemis simplicicollis Say. This species, recorded by Walker from "Ottawa," has been found sparingly at Fairy Lake, Hull, Que. I have not met with it on the Ontario side of the Ottawa River.

From June 15th to June 24th I collected dragonflies in Algonquin Park, Ont.; with headquarters at the Highland Inn on Cache Lake, the main collecting was done in the marshy inlets of this lake, along the railway track west of the Inn, where there is a considerable area of swampy ground, and at the headwaters of the Madawaska river, which crosses the track about one and a half miles west of the Inn and descends to a lower level by a series of rapids and pools. Dragonflies were very plentiful on favourable days, although the black flies at times made collecting almost impossible; besides most of the species mentioned by Dr. Walker in his Algonquin Park list (36th Rep. Ent. Soc. Ont. p. 64) the following species, which constitute new records for the region, were captured.

Coenagrion resolutum Hagen. Not rare in reedy spots.

Chromagrion conditum Hagen. Very plentiful among the reeds on the Madawaska River and marshy spots along the railroad tracks.

Cordulegaster diastatops Selys. Common along a small trickle of water bordering the railroad track about a mile west of the hotel; the ♀'s were observed depositing ova. It was also observed in a small upland bog in the woods back of the Highland Inn.

Cordulegaster maculatus Selys. Found flying with *Macromia illinoiensis* over the pools and rapids of the Madawaska river.

Gomphus spicatus Hagen. One ♂ and one ♀ were captured on the Madawaska river.

Gomphus descriptus Banks. The commonest Gomphus on the Madawaska river.

Dromogomphus spinosus Selys. One ♂ and one ♀ were taken in the woods back of the Highland Inn.

Tetragoneuria canis McLachlan. Moderately common along the railroad track along with *L. proxima*.

Dorocordulia libera Selys. Five ♂'s were taken in a marshy corner of Cache Lake, east of the hotel.

Leucorrhinia hudsonica Selys. Common on roads through the woods in the neighborhood of swamps.

Leucorrhinia proxima Calvert. In countless numbers in the swamps along the track just west of the hotel.

THE NORTH AMERICAN SPECIES OF LABOPS (HETEROPTERA—MIRIDAE).[1]

BY HARRY H. KNIGHT,
University of Minnesota, St. Paul.

KEY TO THE SPECIES OF LABOPS

1. Hairs on hind tibiae shorter than the true spines; hind tibiae uniformly black 2
   Hairs on hind tibiae prominent, in length exceeding the true spines, length of hairs also greater than diameter of tibia; tibiae largely pale or yellowish ..... *hirtus* n. sp.
2. Juga of male strongly inflated, thus concealing base of tylus when viewed from lateral aspect, frons scarcely convex, median line pale; female with frons more prominent but vertex sloping sharply downward in front, median line of frons pale; larger, length 3.5—6 mm. ..... *hesperius* Uhl.
   Juga of male moderately prominent, base of tylus visible as seen from lateral aspect; both sexes with frons strongly convex, meeting the nearly horizontal vertex well forward of the eyes; small, length 3—3.4 mm. .... *tumidifrons,* n. sp.

Labops hesperius Uhler.

Hayden's Surv. Terr., Rept. for 1871, p. 416, (1872).

This species is best distinguished in the original description by the following: "Legs black; the apex of the femora and base and apex of the coxae orange yellow. Scutellum and hemelytra with grayish, prostrate pubescence; ....Abdomen densely sericeous pubescent, ... the posterior segments more or less hairy." A study of considerable material shows that the type of pubescence, as well as coloration of the legs, are constant and distinctive characters.

Our eastern form of *Labops* has usually been determined as *hesperius* Uhler, and although it occurs in Colorado and Montana, the original description clearly indicates which one of the two species the author had before him when drawing up the description.

Specimens examined: MONTANA— ♀ June 30, 1900, Bozeman. ♂ June 26, 1903, Forsyth. ♀ June 27, 1913, Monida. ♂ ♀ June 19, 1921, Willow Creek, Gallatin County (Wm. C. Cook). SOUTH DAKOTA— ♂ June 1, 1921, Capa (H. C. Severin). WYOMING—2 ♂ 2 ♀ July 20—25, 1920, Yellowstone National Park (A. A. Nichol). ALBERTA—18 ♂ ♀ July 1—3, 1915, Maligne Lake (E. L. Diven).

Labops hirtus new species.

Male. *Brachypterous form*, length 4.3 mm., width 2 mm. *Head*: width across eyes 1.7 mm., vertex 1.03 mm.; clothed with prominent, erect, pale yellowish hairs, and intermixed with a few silvery scale-like hairs on vertex and front; juga moderately prominent but not obscuring the base of tylus when viewed from lateral aspect; black, shining, with juga, genae, spot beneath eye, mark on median line of front, spot each side of vertex and extending mesad along base,

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pale to yellowish. *Rostrum*, length 1.5 mm., extending upon middle of hind coxae, black.

Antennae: segment I, length .63 mm.; II, 1.73 mm.; III, .76 mm.; IV .81 mm.; black.

Pronotum: width at base 1.45 mm., anterior angles 1.09 mm.; clothed with prominent, erect, pale yellowish hairs and intermixed with closely appressed scale-like pubescence; black, lower margins of pleura pale. *Scutellum* black, triangular, mesoscutum moderately exposed; clothed like the pronotum. *Sternum* and pleura black, clothed with prominent erect pilose hairs; posterior half of ostiolar peritreme and slender margin bordering intermediate coxae, pale.

Hemelytra: embolar margin arcuate; cuneal fracture present but cuneus poorly developed; membrane absent in brachypterous form; black, embolium and outer margin of corium, and extending beyond the cuneal fracture, pale yellowish; thickly clothed with erect, stiff yellowish hairs, and intermixed with closely appressed, silvery, scale-like hairs.

Legs: coxae black, apices and a spot near base yellowish; femora black, apices yellowish, more or less yellowish at middle but with black color continuous on dorsal surface, the yellow on hind pair forming a line on anterior and on the posterior aspect; tibae yellowish, with base and apex blackish, front pair more nearly black; tarsi black.

Venter: black, shining, clothed with prominent, erect yellowish hairs, and with a few scale-like hairs near base.

Macropterous form, length 5.7 mm., width 2.3 mm.; similar to the brachypterous form but with membrane fully developed and fuscous to black in color.

Female. *Brachypterous form*, length 4.6 mm., width 2.3 mm.; more robust but very similar to the male in structure and coloration.

Macropterous form, length 5.7 mm., width 2.6 mm.; similar to the brachypterous form but with membrane fully developed.

Holotype: ♂ July 11, 1917, Cranberry Lake, New York (C. J. Drake); author's collection. *Allotype*: same data as the type. *Paratypes*: MAINE—1 ♂ 1 ♀, July 4, 1915, Paris (C. A. Frost). MONTANA—♂, July 1, 1901, Bozeman, alt. 4800 ft. (E. J. Moore). NEW HAMPSHIRE—1 ♂ 1 ♀, June, 1908, Claremont. ♂, July 6, 1914, Mt. Washington (C. A. Frost). NEW YORK—2 ♂, July 2, ♂, July 3, 2 ♂, July 6, ♂, July 11, ♂, July 22, Cranberry Lake (C. J. Drake). 2 ♀, June 21, 1915, Wilmington (Wm. T. Davis). VERMONT—♂ June 23, 1913, Stowe (G. P. Englehardt). ♀ July 10, 1913, Stratton (P. W. Whitney). WYOMING—2 ♂ 7 ♀ (brachyp.), 5 ♂ 4 ♀ (macropt.), July 20—25, 1920, Yellowstone National Park (A. A. Nichol). CANADA: ALBERTA—♀ June 18, 1919, Edmonton (F. S. Carr). BRITISH COLUMBIA—♂ 2 ♀, July 28, 1920, Chilcotin (E. R. Buckell). ONTARIO—14 ♂ ♀, June 23—July 15, 1915, Parry Sound (H. S. Parish). 2 ♀, June 11—14, 1913, Guelph; ♂, June 12, 1915, Simcoe (H. Caesar). ♂ 4 ♀, June 16, 1917, Strathroy (H. G. Crawford).

Labops tumidifrons new species.

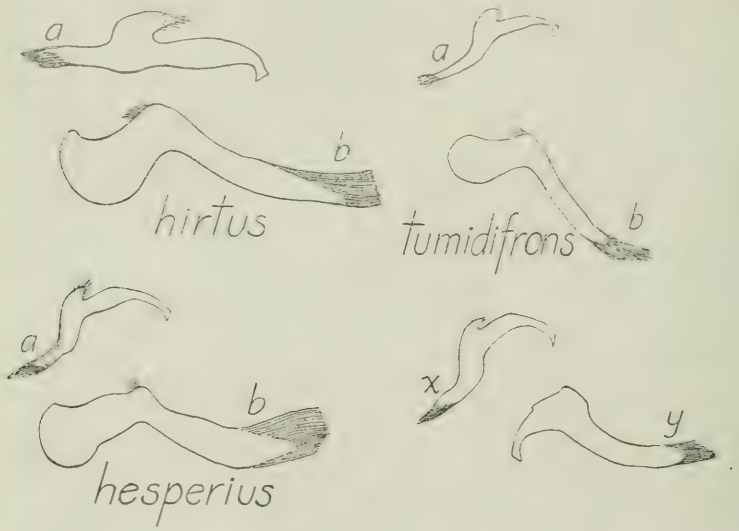
Male. Length 3.4 mm., width 1.3 mm. *Head*: width 1.17 mm., vertex .66 mm.; frons strongly convex, meeting the nearly horizontal vertex at a point just before front margin of eyes; clothed with erect pale hairs, longest on tylus.

front rather thickly covered with closely appressed, silvery, scale-like hairs; black, moderately shining, a white mark each side of vertex and extending mesad along base; juga white, much less prominent than in *hesperius*. *Rostrum*, length .97 mm., reaching to middle of hind coxae, black.

Antennae: black; segment I, length .36 mm.; II, 1mm.; III, .53 mm.; IV, .61 mm.

Pronotum: length .60 mm., width at base 1.14 mm., anterior angles .74 mm.; black, lower margins of pleura pale; clothed with erect pale hairs, intermixed with closely appressed, silvery scale-like hairs, the same extending to cover sides of thorax and abdomen; ostiolar peritreme black, scarcely paler along posterior margin; slenderly pale bordering base of intermediate coxae.

Hemelytra: fully developed, black, embolium and outer margin of cuneus pale, membrane uniformly blackish; clothed with erect, pale yellowish hairs, and intermixed with scale-like hairs, the latter thickest on clavus and corium.



Male genital claspers of species of Labops, a, left clasper, lateral aspect. b right clasper, lateral aspect. x, y, left and right claspers, y, showing aberrant form of right clasper in two specimens of *Labops hesperius*.

Legs: black, apices of femora, and tips of coxae, pale; femora beset with prominent erect hairs, pubescence on tibiae short, not equal to length of true spines.

Venter: black, clothed with erect pale yellowish hairs, the sides bearing scale-like hairs; genital claspers distinctive although showing a close relationship with *hesperius*.

Female. length 3.1 mm., width 1.4 mm.; brachypterous, hemelytra reaching to near tip of abdomen, cuneal fracture present but membrane scarcely developed; shape of head, pubescence, and color, similar to that of male although the body slightly more robust.

Antennae: segment I, length .34 mm.; II, .85 mm.; III, .50 mm.; IV, .61 mm. *Head*: width 1.2 mm., vertex .71 mm.

Holotype: ♂, June 15, 1920, Chilcotin, British Columbia (R. C. Treherne); Canadian National Collection. *Allotype*: taken with type; author's collection. *Paratypes*: 3 ♂, taken with the types.

Labops burmeisteri (Stal) has been recorded from this continent but the writer has not seen specimens that have been collected in North America. There is at hand for comparison and study, a specimen of *burmeisteri* determined by Reuter (♀, Shigansk, Lena infer. Russia, B. Poppius), which comes from a region near the type locality of the species. *Burmeisteri* comes nearest to *hirtus* but differs somewhat in form as well as in pubescence and color of the legs.

In the above figure, left and right genital claspers are illustrated, drawn from two specimens which in all other respects should be referred to *hesperius* Uhler. It seems worthy of remark that two specimens should be found, both showing the right clasper modified to a form very similar to the left clasper. The most logical explanation for these unusual specimens would seem to be that they represent a reversion of the right clasper back toward the primitive, bilaterally symmetrical form of clasper. In *Labops, Lopidea, Orthotylus,* and several other genera of Miridae, the left clasper is very little modified throughout the species in each genus. In other words, the left clasper is generic in character while the right clasper is indicative of the species. From this it would seem that the left clasper has remained more primitive while the right clasper exhibits great change in form with the development of new species. The above figured specimens of *Labops* seem to show that sudden reversion of the right clasper may take place, probably in a single generation, for among eighteen specimens of *hesperius* taken at the same time, all other male specimens were normal for the species. The writer has also found a single male of *Lopidea,* taken with a large series of *L. arizona*, which exhibits a similar condition of claspers. The right clasper is almost identical with the left clasper, or at least its bilaterally symmetrical counterpart. This specimen differs from the typical *L. arizona* in being much smaller, although quite similar in coloration. Thus we have two examples of species in different genera, each exhibiting reversion of the right genital clasper toward a more primitive form. The question naturally arises,—have not new species of plant bugs been created with the same sudden change, but by modification of the genital clasper in a different direction, or away from the bilaterally symmetrical type? The numerous species of the genus *Lopidea* would seem to support this view, yet nearly every species has its own particular food plant.

OXYHAEMOGLOBIN PRESENT IN BACKSWIMMER *BUENOA MARGARITACEA* BUENO (HEMIPTERA).

BY H. B. HUNGERFORD,

Kansas University, Lawrence, Kansas.

Some six years ago, while engaged in the study of the biology of the above named Notonectid, I discovered the presence of some blood red masses in the abdomen of these bugs. These masses are of such strikingly brilliant hue and so unusual in color for insect tissue that they led to a superficial examination at that time. They are grouped about the several tracheal trunks which have their connections with the abdominal spiracles opening in the ventral air groves. Each of these red masses is made of many very red, more or less oval cells, that appear bound together by the innumerable branchings of tracheae. These cells haemolyze quickly in distilled water but retain their red pigment contents in normal salt solution. The clusters of these cells about each tracheal trunk appear compound, and are of considerable size, so that the entire red mass fills much of the abdominal space. They lend their vivid color to the insect showing through the somewhat transparent tissues of the sides and dorsum of the abdomen and give the entire venter a very dark red color. I have noted[1] that the venter of the abdomen is deep red in living specimens and that it darkens in museum material. The fact that these bodies become very dark after death combined with my observations that Buenoa seldom comes to the surface of the water, but is content to poise and swim submerged, where the insect seems to be in perfect equilibrium, suggested to me the possibility that the red might indicate haemoglobin. These large clumps of red cells are most intimately connected with the respiratory system, and might well serve to fix and store the oxygen as a reserve supply. They are conspicuously present from the second instar on, and, indeed, are found in the abdomen of the embryo not yet hatched. In spite of the exceedingly interesting possibilities to be revealed by a study of these scarlet organs, it was only recently that a test was made for haemoglobin. The following tests were made with the assistance of Dr. N. P. Sherwood, Professor of Bacteriology, whose experience in blood tests was invaluable and whose interest in this problem has been as great as my own.

SPECTROSCOPIC TEST.

These red cells when placed in distilled water haemolyze readily, and the fluid thus obtained and examined with the Spectroscope shows very distinctly the two absorption bands between D. and E. Controls were run with sheep's blood and human blood.

TEICHMANN'S TEST FOR HAEMIN CRYSTALS.

The technique suggested by Teichmann was used and definite brownish crystals were consistently obtained. Proper controls were run to guard against faulty technique.

In addition to the above Spectroscopic and Hæmin crystal tests, chemical tests such as Weber's Guaiac test for blood gave positive reactions.

All of these tests were clearly positive, and we are thus able to report that we have in this case an insect containing definite, bright red clusters of cells,

1—Hungerford, H. B.—Biology and Ecology of Aquatic and Semiaquatic Hemiptera—Kansas University Science Bulletin Vol. XI, pg. 194, 1919.

enmeshed and closely associated with the tracheal system of the abdomen, which contain oxyhaemoglobin.

In the case of Chironomus (the blood worm), which has been cited frequently as the only insect possessing hæmoglobin, the red fluid is free in the body cavity, and when the larva is punctured flows out at once. Rollet[2] in 1861 discovered hæmoglobin crystals in this pigmented material and Lankester[3] in 1867 noted that it gives the characteristic absorption-spectrum of hæmoglobin—Cuenot[4] 1891 who investigated the blood and lymphatic systems of many vertebrates and invertebrates is often cited in connection with the above case. A case more interesting and structurally more like the one I am reporting, is that of the larva of *Gastrophilus equi*. Berlese[5] gives a discussion of the literature relating to the discovery and study of certain pink cells related to the tracheal system in these Bot fly larvae. He cites Vaney[6] as showing that the red color of these "cellules tracheales" is due to hæmoglobin which he appears to have thought was secured in some manner from the host. Vaney found further that the hæmoglobin tended to disappear following the larval period. Both the above mentioned records are in the Diptera. We are pleased, therefore, to report the presence of oxyhaemoglobin in definite cell clusters in the free swimming Aquatic Hemipteron *Buenoa* and to suggest that it is, no doubt, present also in the closely allied genus, *Anisops*. Since these insects are not parasitic, the hæmoglobin is produced by them, and has a normal physiological function to perform.[7]

ON THE GENUS ELIDIPTERA (HOMOP.)

BY Z. P. METCALF,
N. C. State College, Raleigh, N. C.

In a recent number of the Canadian Entomologist (Vol. LIV:61) Mr. Muir calls attention to the fact that an examination of *Elidiptera callosa* Spin. from Trinidad, the logotype of the genus *Elidiptera* Spin., shows that our North American species assigned to *Elidiptera* by Van Duzee (Cat. N. A. Hemip. p. 726) do not belong to this genus. Muir says that certain species will "fit into *Angeleusa* Kirk. (*Argeleusa* Kirk.) and have a distinct median carina on the clypeus." However, I cannot agree that our Eastern North American species belong to *Argeleusa* which has the following characters that do not agree with our species. "Vertex basally distinctly angulately emarginate; not impressed; tibiae obscurely spined near the base," etc.

I do not believe that the median carina on the clypeus is a reliable character in this genus as some of our species (*opaca* Say) have a very distinct median carina, while other species (*slossoni* Van D. and *variegata* Van D.) have a fainter carina. In certain other species (*pallida* Say and *septentrionalis* Prov.) the median carina on the clypeus is almost wanting.

2—Rollett, A. Zur Kenntniss der Verbreitung des Haematin—Sitzungsb. Wien. Akad. XLIV, pp. 615-630. 1845.
3—Lankester, E. R. A contribution to the knowledge of Haemoglobin—Proc. Roy. Soc. XXI, pp. 70-81. 1873.
4—Cuenot. Etudes sur le sang et les glandes lymphatiques dans le série animale—Arch. Zool. exper. et gen. 1902.
5—Berlese, A. Gli Insetti pp. 769 and 822. 1909.
6—Vaney, C. Contribution á l'étude des larves et des métamorphoses des Diptères. Thése de Lyon—Ann de l'Univ. de Lyon. Nouv. sér. 7.
7—A complete study of the histology and development of these interesting cells is under way.

In casting about for a name to take the place of *Elidiptera* we find that Amyot and Serville (Nat. Hist. Ins. Hemip. p. 526) propose *Helicoptera* on the basis that it expresses in more correct Greek the idea of the overlapping wings which Spinola tried to express by his name *Elidiptera*. They describe *Elidiptera cincticeps* Spin. only under *Helicoptera* and list *E. marginicollis* Spin., *E. advena* Spin. and *E. callosa* Spin. *E. cincticeps* might therefore be considered the type of the genus *Helicoptera* but according to Banks and Caudell, Entomological Code rule 105; "the type of a new generic name which by sign or language is clearly shown to be proposed to replace another valid generic name is the same as that of the genus replaced," and since, Entomological Code rule 86, emendations such as this are not permitted, *Helicoptera* becomes a straight synonym of *Elidiptera*. It is doubtful if *Helicoptera* with genotype *E. cincticeps* would be available anyhow, as Spinola states in the original description of *cincticeps* "En differe (from the other species of *Elidiptera*) par l'absence totale d'une arete mediane sur la face frontal."

With these points in mind, therefore, I propose the name *Epiptera* for this genus, which may be described as follows:

Epiptera new genus.

Orthotype, *Falta opaca* Say.

This genus may be recognized by the narrow head with projecting vertex, by the rather long pronotum and overlapping wings.

Head narrow, not over half as wide as the pronotum; vertex projecting in front of the eyes, with carinated margins, median line sulcate, posterior margin broadly arched; frons and clypeus together about eliptical; frons narrowed above between the eyes widened gradually to near the clypeal margin and then contracted, laterally and medianly carinate; clypeus more than half as long as the frons; medianly and laterally carinate, the former sometimes faint; second joint of antennae terrete about three times as long as the first; basal knob of the flagellum rather distinct; flagellum short, about twice as long as the segments of the antennae; compound eyes elongate; ventral sinus inconspicuous; ocelli conspicuous, placed below the compound eyes anterior to the antennae; pronotum projecting triangularly between the compound eyes; the margins of this triangle carinate with these carinae extending almost to the posterior margins; posterior margin deeply triangularly notched with the anterior and posterior margins about parallel; the lateral lobe of the pronotum is quadrate nearly twice as long as broad; mesonotum tricarinate, nearly three times as long as the pronotum; legs simple; anterior femora and tibiae nearly equal; posterior tibiae approximately twice as long as the femora; with a single strong lateral tooth beyond the middle; basal joint of the posterior tarsi nearly twice as long as the second and third combined; claws strong; fore wings opaque, overlapping apically, venation distinct, subcosta and radius united basally; subcosta two with many accessory branches between it and costal margin; radius with a few similar branches; medius typical, four branched, some of which branch again before the apical margin; cubitus two branched, with several accessory veins before the apical margin; the cross veins connecting the branches of the various veins form a crenulate submarginal vein; second and third anals united about two-thirds of the distance from the base of the clavus; the common stem running to the apex of the clavus.

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POPULAR AND PRACTICAL ENTOMOLOGY

NOTES ON A MIGRATION OF LIBYTHEA BACHMANNI KIRTL.

BY CHARLES H. GABLE and W. A. BAKER,

Bureau of Entomology, U. S. Department of Agriculture.

The first individuals of a migration flight of the butterfly, *Libythea bachmanni* Kirtl., were observed by W. A. Baker passing the Field Laboratory, Cereal and Forage Insects, San Antonio, Texas, at two o'clock p.m., September 26, 1921. The butterflies increased so rapidly in numbers that it was decided to determine the extent of the migration and gather such other information as might prove of interest.

Personal investigation aided by reports from every part of South Texas indicated that the butterflies were advancing on a front extending from a point fifty miles north of San Antonio due south to the Rio Grande River, a distance of approximately two hundred and fifty miles. Careful tests indicated that the average flight was four and one-half miles per hour, and, in the vicinity of San Antonio, the estimated number of butterflies passing per minute over each rod of front during the hours of flight was seventeen. Since the flight was very uniform along the entire front, this would mean that approximately one and one-quarter million butterflies were passing a line at right angles to their line of flight each minute.

The direction of flight was slightly south of east at all times. The prevailing wind was from the south or east of south, but usually was not strong enough to affect the direction of flight. There was a stiff breeze from the northeast in the forenoon of September 30. During this time the butterflies were travelling very high in the air, some of them at an altitude of over a hundred feet, and could barely be seen. It is possible that others were still higher. They seemed to seek higher altitudes in an effort to overcome the obstruction of the wind. This inclination was also noted where obstructions such as buildings and trees were encountered. In each case the butterflies ascended to such height as enabled them to go over the obstruction, and never around it. The direction of the wind did not seem to materially alter the original direction of flight since it was noted that, although the butterflies were advancing in a more southerly direction, each individual was facing its original direction of south of east and was attempting to make headway in that direction.

The flight at San Antonio continued with uniform intensity for eighteen days, after which the numbers gradually diminished, although some specimens were noted in timbered sections until the first freeze, December 5.

The forward movement was continued until they arrived within about thirty miles of the coast. There occurred a considerable banking up or accumu-

lation of individuals for several days on a front parallel to the coast line after which they seemed to turn back to the west. They, however, did not proceed in this new direction except for a short distance, but seemed to lose their inclination for a definite line of flight and wandered aimlessly about the country.

The butterflies fed freely on many flowers such as Rock Brush (*Eysenhardtia amorphoides* H. B. K.), Madeira vine, and a considerable number of other plants in bloom at that time. Water, whether in a creek, stagnant pool or merely moist ground, exerted a very strong attraction and caused the butterflies to congregate in swarms. They appeared in large numbers in cotton fields attacked by the cotton worm (*Alabama argillacea*) where they seemed to be feeding on the plant juices exuding from the edges of the leaves cut by the worms.

The females for the most part were gravid, but observations failed to note oviposition on any plants in the vicinity of San Antonio with the exception of one observation by H. B. Parks, who stated that he noted a female ovipositing on *Hymenopappus artemisiaefolius* D. C., which is rather a common weed throughout Texas. Unfortunately, we were unable to relocate the eggs for hatching purposes, nor was it possible to find other eggs in the same locality, although butterflies were present in abundance. One female oviposited in a cage and the eggs hatched, but the proper food for the larvae was not found.

One of the butterflies was caught in a net and whirled rapidly about the head twenty-five times in a horizontal plane, the object being to determine if the sense of direction could be affected. When released, the butterfly immediately took the original line of flight. The same experiment was made whirling the net about in a vertical plane at right angles to the line of flight; also in a plane in the same line as the line of flight, with the same results as in the first experiment. The number of revolutions was then increased to fifty and the experiments repeated with the same results. The experiment was then made of whirling the net fifty times in a horizontal plane and fifty in a vertical plane at right angles to the line of flight, the same insect being used. When released, the butterfly immediately resumed its original line of flight. Two of the specimens had lost their palpi and were otherwise rubbed. One specimen alighted on a plant after travelling about fifty feet, but when disturbed, it resumed its flight and continued until lost from sight in the distance.

As previously noted, when first observed the butterflies had already started their migration. This reason and the fact that the source of the migration was several hundred miles from San Antonio, where flight was first noted, of necessity prevents any definite proof of the breeding place of these insects. However, from data obtained from all parts of area covered and from observations as to direction of flight, it may be stated at this time that the probable breeding place is somewhere in the so-called "Big Bend" country of North Mexico directly west of South Texas.

The territory ultimately covered was that portion of Texas south of a line starting fifty miles northwest of the mouth of the Pecos River; extending almost due east to a point sixty miles north of San Antonio; thence southeast to within thirty miles of the coast; and north to the Rio Grande River, paralleling the coast line.

THE NORTH AMERICAN SPECIES OF PHYLLOXERA INFESTING OAK AND CHESTNUT. (HEMIPTERA: PHYLLOXERIDAE)

BY CARL D. DUNCAN,

Stanford University, California.

The present paper is based upon a study of five species of *Phylloxera* that are certainly new, a sixth that is probably new and four described species.

The writer is indebted to Mr. W. M. Davidson of the United States Bureau of Entomology for the collection of one of the new species, to Professor R. W. Doane of Stanford University for one, and to Professor G. F. Ferris of Stanford University for two. Dr. A. C. Baker of the Bureau of Entomology has very kindly lent material of *P. rileyi*, *P. quercetí* and *P. castaneae* from the National Collection. To each of the above gentlemen the author expresses his sincere thanks. They are especially due to Professor G. F. Ferris because of his enthusiastic encouragement and helpful criticism and many suggestions during the preparation of this paper. He also mounted most of the specimens except those lent by Mr. Davidson and Dr. Baker.

The one thing above all that the present bit of work has made plain to the writer is the extent to which the American species of *Phylloxera*, particularly those infesting oaks, need study. Until 1919 but two American, oak-infesting species were known. In that year Ferris described *P. stanfordiana* and until the present these three species have been all that have been known from our oaks. The species here described as new have been discovered almost purely through accident and it appears probable that a thorough examination of our various oaks will increase the list several fold. Several of the species, even if not at present of economic importance, may in time become so, and it is hoped that this paper may serve to stimulate observers to look for and collect these interesting insects.

A word as to the preparation of specimens for study may not be amiss. One should not hope to obtain satisfactory specimens by mounting them directly in balsam, as such specimens shrink, the legs double up beneath them, and many of the details of structure which are of specific importance are likely to be obscured. The material upon which Pergande based his descriptions was prepared in this manner, and from its condition it is surprising that he was able to accomplish anything with it. As it is, his work leaves much to be desired.

Specimens should at least be passed through ninety-five per cent. alcohol and cleared in carbol-xylene or some other clearing medium before being put into the balsam. A still better method, however, is that of clearing the specimens in caustic potash and staining with magenta in the manner that is now generally followed in the preparation of Coccidae and similar small insects. This method gives excellent preparations which well repay the small amount of effort expended in securing them. All the structures are plainly visible, not being obscured by the body contents. Specimens so treated straighten out much better also.

General Morphology.

The alate forms of but three species, *P. rileyi*, *P. castaneae*, and *P. davidsoni* have been available to the author. These show but little variation and give

but little promise, except in the antennae, of furnishing characters for separating the species. Further study of material including a larger number of species may disclose usable characters, but this at present seems unlikely. A figure of the alate form of *P. castaneae* is appended to this paper and will give an idea of the general features of this form. The antenna of this species differs from that of *P. rileyi* and *P. davidsoni* in that the third segment bears but one large sensorium instead of two.

The best—if not only—reliable characters for separating the species are to be found in the apterous agamic females. The descriptions and figures given in this paper are based almost entirely on this form. The figures are from reconstructed camera lucida drawings, except that of the ovipositor, which is free-hand, and all were made by the author. The figures are not drawn to a uniform scale, but since the specific characters depend upon the relative proportions of the different parts of the same insect, this condition does not interfere with their usefulness. Figures of *P. rileyi, P. querceti* and *P. castaneae* are included to supplement the rather unsatisfactory figures given by Pergande in his paper of 1904.

The apterous agamic females of the group, which may be called the *P. rileyi* group, to which the species herein described belong, are characterized by the development in greater or less degree of tubercles on the dorsum. These are arranged in a very definite and constant fundamental pattern, there being six rows, one on each lateral margin extending the full length of the body, one of similar extent on each side of the median line, and a thoracic row of but three tubercles interpolated between the submedian and lateral rows on each side. The tubercles are longest on the posterior part of the thorax, shorter on the head and much reduced or even obsolete on the posterior part of the abdomen. When they are obsolete their positions are still marked by small setae. They vary in size in the different species from very tiny elevations, which scarcely deserve to be called tubercles in *P. stanfordiana*, to very conspicuous, elongated processes which in *P. rileyi* nearly equal the antennae in length. Each tubercle is provided at the apex with a stout, parallel-sided seta with a somewhat mushroom-shaped apex. These setae are practically equal in length on all the tubercles of a single specimen.

In addition to this, the tubercles are provided with secondary roughenings in the form of tiny chitinous points or spines which are usually larger toward the base of the tubercles and which may be spirally arranged around the tubercle or unevenly distributed. In most of the species there are four relatively stout secondary spines surrounding the seta at the apex of the tubercle. There are no pore areas such as are characteristic of the genus *Phylloxerina*.

The integument is generally roughened in some manner, usually by the presence of slight wrinkles, which may give it a reticulated appearance, or by innumerable chitinous points or by minute pits. These roughenings are of aid in making specific determinations.

There are but two pairs of spiracles, the thoracic ones, those of the abdomen apparently being entirely absent.

The antennae are three-segmented, the third segment being irregularly annulated and bearing just below the tip a large, oval sensorium and from two to four very small secondary sensoria, which are frequently difficult to see, along

the margin of the primary sensorium. Figures of the antennae are given, though only in exceptional cases are they referred to in the descriptions, since they appear only rarely to offer characters of specific value.

The beak varies considerably in length and in the number of apparent segments. Whether these divisions represent true segments is not evident from the material at hand, but they are definitely marked and are of some value in making determinations.

The legs, though annulated in some species and not in others, show very little variation and present no reliable specific characters.

The body is pyriform and shows but little segmentation, at least in mounted specimens, except on the abdomen where there is occasionally an indication of the posterior segments.

The position of the eye is somewhat variable. It is shown in the accompanying figures as being on the dorsum in some species and the venter in others. This difference is of significance and is due to the manner in which the specimens are flattened out on the slide which again depends upon the degree to which the living insect was distended.

The presence on the apex of the abdomen (Plate 10, fig. 2) of a pair of small, chitinous structures resembling a pair of approximated rods and functioning probably as an ovipositor will distinguish the mature females, either apterous or alate, from immature forms.

Specific Descriptions.

The only characters given in the following descriptions are those which are of value in making specific determinations. For all other characters the section on general morphology may be consulted.

Phylloxera stellata new species.

Plate 11, figs. 2, 8, 15, 25.

Apterous female (Plate 11, fig. 8). Length of type (flattened on slide) .45 mm. Tubercles (Plate 11, fig. 2) large, more or less globular, each supplied with a number of knob-like secondary projections and small spines, giving a stellate appearance, whence the name. Derm with a minute reticulation formed by tiny chitinized wrinkles and spines which is difficult to see except in well stained specimens and is in any case best developed on the head and thorax. Beak three-segmented, attaining the hind coxae. Legs (Plate 11, fig. 15) rather stout, the tibia annulated, the annulations, however, appearing indistinct on lightly stained specimens.

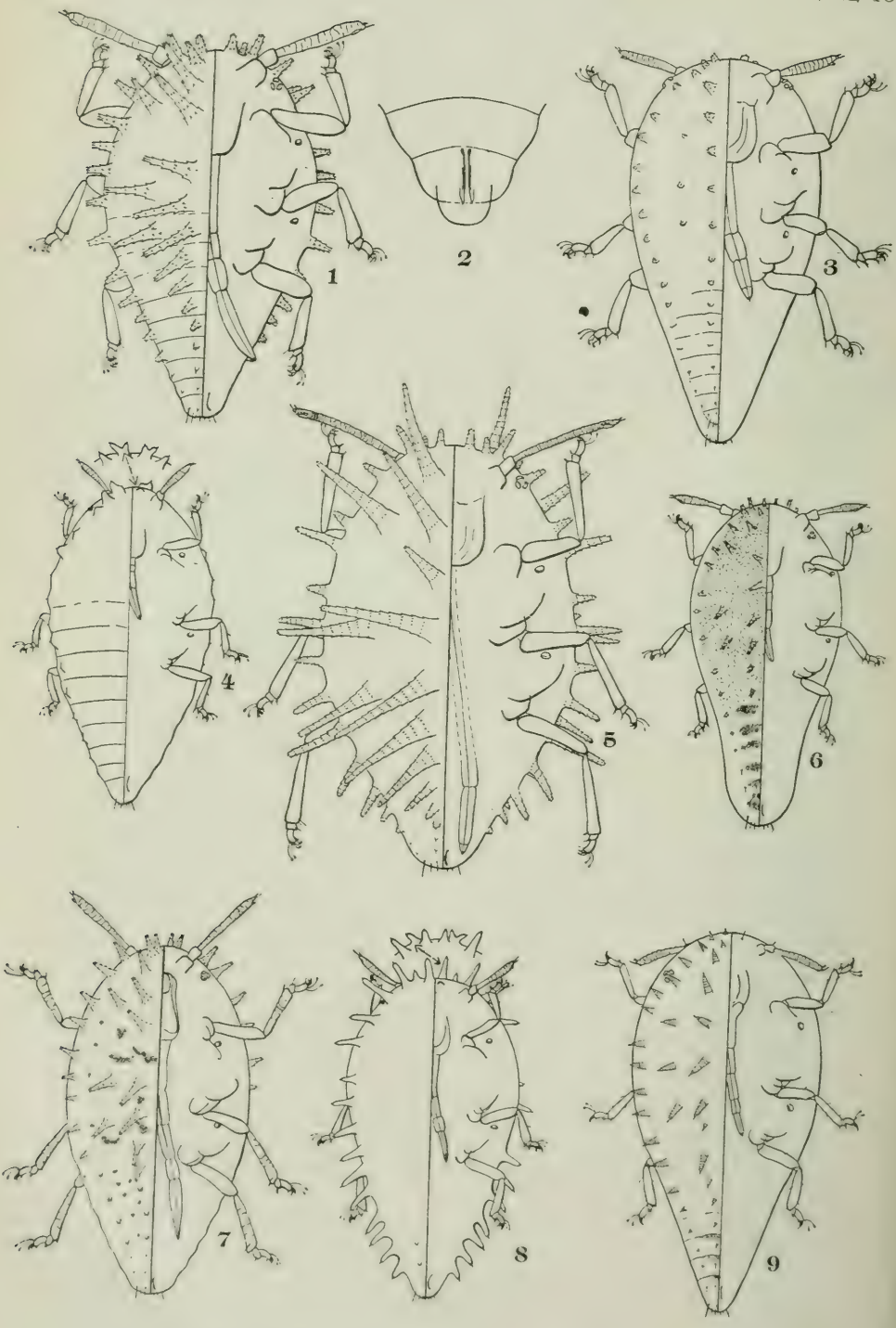
Type Host and Locality. From an oak which appears to be either *Quercus margaretta* or *Q. alba,* Dallas, Texas, Aug. 17, 1921, G. F. Ferris.

Holotype and *Paratypes* in the Stanford University collection and a paratype slide in the National Collection.

Notes. This is the most distinctive species of the group, as none other has the stellate type of tubercles. No alate specimens were secured. The apterae occur thickly distributed over the under surfaces of the leaves and each produces a small, brown, discolored area, so that the leaves have a speckled appearance. No distortion of the leaves occurs. The illustrations, except figure 15 of Plate 11, are from the holotype.

CAN. ENT. VOL. LIV.

PLATE 10.



NORTH AMERICAN SPECIES OF PHYLLOXERA.

Phylloxera reticulata new species.

Plate 10, fig. 9; Plate 11, figs. 11, 12, 24.

Apterous female (Plate 10, fig. 9). Length of type (flattened on slide) .75 mm. Tubercles (Plate 11, fig. 11) prominent, elongate conical, provided with very many tiny, spine-like points which are arranged spirally from base to apex. Length of apical setae five or six times its diameter, much greater relatively than the apical setae on any of the other species here described. Eighth tubercle of each of the sub-median rows much shorter than either the seventh or the ninth. Derm (Plate 11, fig. 11) minutely wrinkled, the wrinkles chitinized and forming a finely reticulated pattern much as in *P. stellata,* these reticulations not evident posteriorly on the abdomen. Posterior abdominal tergites slightly chitinized Beak four-segmented, attaining or slightly exceeding the hind coxae. Legs with the annulations faintly or not at all evident.

Type Host and Locality. From *Quercus kelloggii,* Jasper Ridge near Stanford University, California, October 11, 1921. Collected by the author.

Holotype and *Paratypes* in the Stanford University collection and a paratype slide in the National Collection.

Notes. Apterae only were found. These were present scatteringly along the veins on the under surface of the leaves on a single tree. A search of other trees in the immediate vicinity yielded no additional material. Eggs and developing young in all stages were present, all being bright orange yellow in color, the adults having the eyes reddish. Eggs oval; shortly before hatching they present a reticulated appearance and the eyes of the embryos show through.

The character of the secondary spines on the tubercles will distinguish this from all other species except *P. rileyi* and *P. castaneae,* which, however, are easily distinguishable by the exceedingly long tubercles in the case of the former and the apparent lack of dorsal tubercles in the case of the latter.

Phylloxera davidsoni new species.

Plate 10, fig. 7; Plate 11, figs. 6, 19, 26.

Apterous female (Plate 10, fig. 7). Length of type (flattened on slide) .73 mm. Tubercles (Plate 11, fig. 6) prominent, elongate conical, the longest about two thirds as long as the hind femora, provided with secondary spines which are prominent and stout at the base of the tubercle and become smaller toward its apex, armed at the apex with four prominent spines which surround the apical seta. Derm minutely roughened (Plate 11, fig. 6) with relatively broad, low, more or less wart-like, minute protuberances which may or may not be provided with chitinous points. Dorsum with a number of internal, chitinous (?), rounded, oval or beaded structures which show a fairly close bilaterally symmetrical arrangement. In Plate 11, fig. 7, these are indicated by stippled areas. Beak five-segmented, attaining a point two thirds of the distance from the hind coxae to the tip of the abdomen. Legs annulated, relatively longer and more slender than in *stellata.*

Type Host and Locality. From *Quercus engelmanni,* Alhambra, Los Angeles County, California, November 7, 1919. Collected by Mr. W. M. Davidson.

Holotype. In the Stanford University collection; one slide of paratypes in the National Collection; remainder returned to Mr. Davidson.

Notes. The following are extracts from Mr. Davidson's notes. "On the lower surface of tomentous young foliage; alates, aptereae and eggs collected. Eggs are short oval, pale yellow when deposited, becoming darker as incubation proceeds. Shortly before the larva hatches the eye spots are visible and the chorion assumes an appearance as though embossed with hexagonal elevations. Larva is pyriform, light yellow, with blackish spines. Apterae from light orange to yellowish brown, appendages dusky yellowish-gray. Beak of young larva reaches beyond apex of abdomen. Alates orange with black thorax and mesosternum. Antennae of young larvae relatively long, the distal joint longer than the hind tibia."

The accompanying drawings were made from the holotype.

Phylloxera similans new species.

Plate 10, fig. 6; Plate 11, figs. 3, 13, 23.

Apterous female (Plate 10, fig. 6). Length of type (flattened on slide) .7 mm. Tubercles (Plate 11, fig. 3) moderately prominent, elongate conical, the longest, however, not longer than the tarsus, ornamented with secondary spines which are relatively stout and sharply pointed and are longest at the base of the tubercles; apex of the tubercles armed with four relatively stout spines surrounding the apical seta. Derm (Plate 11, fig. 13) of head and thorax and basal half of abdomen with exceedingly numerous, minute, heavily chitinized wrinkles and points. Beak four-segmented, not quite attaining the hind coxae. Abdominal tergites slightly chitinized. Legs without annulations.

Type Host and Locality. From "Bur oak," which is probably *Q. macrocarpa*, Staten Island, New York, summer 1917. Professor R. W. Doane.

One slide bearing holotype and three paratypes alate nymphs in the Stanford Collection.

Notes. This species is quite closely related to *P. davidsoni* of southern California. The difference in the character of the integument, the shorter tubercles with their relatively larger secondary spines and the shorter beak will separate it from the latter, however.

Phylloxera tuberculifera new species.

Plate 10, fig. 3; Plate 11, figs. 7, 10, 27.

Apterous female (Plate 10, fig. 3). Length of type (flattened on slide) .5 mm. Tubercles (Plate 11, fig. 7) but little higher than broad, smaller than in any other known oak-infesting species except *P. stanfordiana*, armed with several small secondary spines and surmounted by the usual seta. Derm (Plate 11, fig. 10) with minute wrinkles and points, these being so chitinized as to give an appearance of short, disconnected, irregular lines. Beak four-segmented, slightly exceeding the hind coxae.

Type Host and Locality. From what appears to be *Quercus havardii*, the "shinnery oak," on the edge of the Staked Plains near Quitaque, Texas, August 23, 1921. Collected by G. F. Ferris.

Holotype and *Paratypes* in the Stanford University collection.

Notes. Apterae only were collected. They occur thickly scattered over the under surface of the leaves. The injury resulting from their feeding produces a multitude of tiny brownish spots.

Phylloxera querceti Pergande.

Plate 10, fig. 1; Plate 11, figs. 4, 17, 21.

1904. *Phylloxera querceti* Pergande, Proc. Davenport Acad. Sci. 9: 263-5; plate 20.

Apterous female (Plate 10, fig. 1). Length flattened on slide) .45 mm. Derm minutely roughened, the condition of the specimens on the slides at hand, however not being such as to enable me to determine the nature of this roughening. Tubercles (Plate 11, fig. 4) prominent, elongate conical, the longest nearly if not quite as long as the femora, provided with many relatively stout and sharp secondary spines and terminating in four sharp spines surrounding the apical seta. Beak four-segmented, relatively long, though not quite attaining the tip of the abdomen. Legs stoutish, apparently without annulations.

Type Host and Locality. From *Quercus alba, macrocarpa, panonia* and *daimio,* Washington, D. C., according to Pergande.

Notes. The specimen figured is from the National Museum material lent by Dr. Baker. The slide bears the following notation, "47|22. Phylloxera on Q. macrocarpa. D. C. Aug. 20, '83" The slide bears three cover glasses, under the middle one of which, indicated by a ring of ink, is the specimen figured. As this specimen was undoubtedly in Pergande's hands when his description of the species was drawn up, it may be designated as the lectotype.

The material received from Dr. Baker contains also four other slides, labeled as *P. rileyi* and bearing the notations, 372 x 47|25; 372 x 47|18; 372 x 47|19; 372 x 65|18, which I believe likewise to represent *P. querceti.*

This species is closely related to *P. davidsoni* from which it may easily be distinguished by the markedly longer tubercles and the stouter and non-annulated legs.

Phylloxera rileyi Riley.

Plate 10, fig. 5; Plate 11, figs. 9, 14, 16.

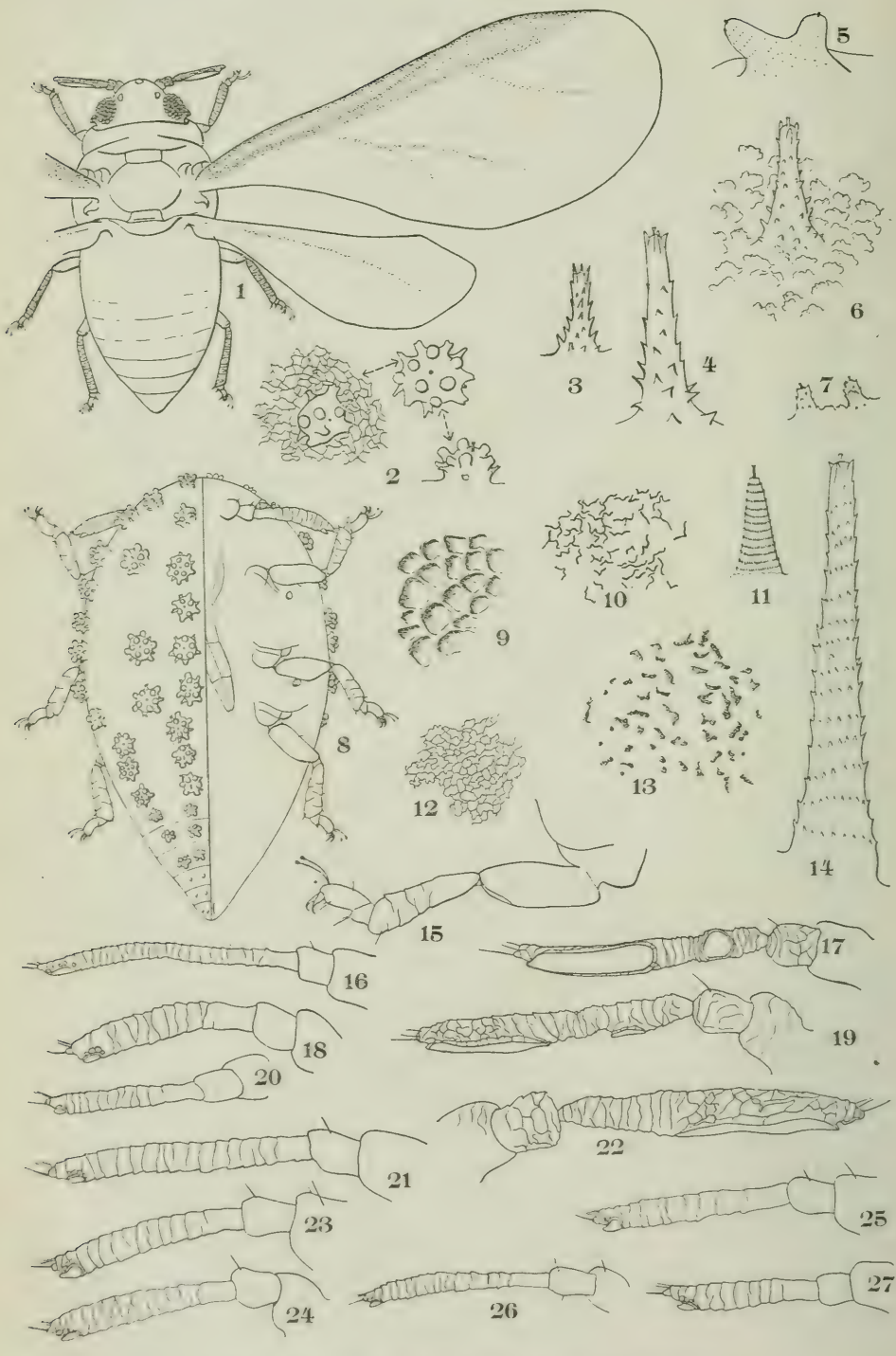
1874 *Phylloxera rileyi* Lichtenstein, Riley, Missouri Report 6: 64-5; figs. 18, 19.
1875. *Phylloxera rileyi* Licht., Riley, Missouri Report 7: 118-121; fig. 22.
1875. *Phylloxera rileyi* Licht., Comptes Rendus de Séances de L'Academie des Sciences, p. 1223. (without description).
1875. *Phylloxera rileyi* Licht., Stet. Ent. Zeit., p. 359. (without description).
1904. *Phylloxera rileyi* Riley (Licht. mss.)., Pergande, Proc. Davenport Acad. Sci. 9: 261-3; pl. 19.

Apterous female (Plate 10, fig. 5). So-called "black form." Length (flattened on slide) .6 mm. Tubercles (Plate 11, fig. 14) very conspicuous, the longest as long as the third antennal segment, provided with exceedingly numerous points arranged in a spiral, and terminating in four relatively stout and sharp secondary spines which surround the apical seta. Derm (Plate 11, fig. 9) roughened by the numerous pits which produce a tessellated appearance. Beak long, attaining the tip of the abdomen. Antennae (Plate 11, fig. 16) and legs unusually long and slender, the latter without annulations.

Type Host and Locality. Riley records it merely from "white oak" and "post oak" without any statement as to locality. According to Pergande (1904) it was taken from *Quercus alba* and *Q. obtusiloba* near Kirkwood, Missouri.

Notes. In the material received from the National Collection there is a single slide mount of three specimens of the so-called "black form," which according to Pergande is the true adult, apterous agamic female of the species.

CAN. ENT. VOL. LIV. PLATE II.



NORTH AMERICAN SPECIES OF PHYLLOXERA.

The slide at hand is apparently that from which Pergande made his description and figures and it is upon this that the description and figures given here are based. It bears the notation, "372 x 47|2 1 : 1 1|42. Rileyi. Black female and eggs from winged female."

Of the twenty eight slides received from the National Collection and labelled as *P. rileyi* on their envelopes, one bears the notation "P. quercus? France?" on the slide itself and is obviously not *P. rileyi*; four bear specimens that the author considers to be *P. quercetí;* three bear specimens the identity of which is doubtful, the tubercles being practically obsolete; one, labeled "Phylloxera n. sp.?" bears a single larva which resembles the form with obsolete tubercles; six contain specimens of what is apparently the so-called "light form" of *P. rileyi.* These agree quite closely with the specimens of the "black form," differing in but minor details, so their identity does not seem to be open to question. Field observations, however, will be necessary before the actual relationship of the "black" and "light" forms can be definitely determined.

Thirteen of the slides contain specimens the identity of which it is impossible to determine because of the condition of the preparations.

P. rileyi may be distinguished from all the other species by the exceedingly long tubercles ornamented with a spiral of minute secondary spines.

Phylloxera stanfordiana Ferris.

1919. *Phylloxera stanfordiana* Ferris, Ent. News 30: 103; fig.

Notes. Since this species was described it has not been rediscovered and there is nothing to add to the original description.

Phylloxera castaneae Haldeman.

Plate 10, figs. 4, 8; Plate 11, figs. 1, 5, 18, 20, 22.

1850 *Chermes castaneae* Haldeman, Am. Jn. Sci. and Arts, (2). 9: 108.

1859. *Phylloxera ? castaneae* (Hald.). Fitch. Third Rept. Noxious Ins. New York, p. 472

1904. *Phylloxera castaneae* (Hald.) Pergande, Proc. Davenport Acad, Sci. 9: 257-61; pl. 18, figs. 143-50.

Apterous female. (Form with long tubercles, Plate 10, fig. 8). Length (flattened on slide) .75 mm. Tubercles (Plate 11, fig. 5) present only along the margins of the body, well developed, the longest, however, only about three fourths the length of the femora, with exceedingly minute secondary spines and with the apical seta shorter than in any of the other species, it being but little more than twice as long as its own diameter. Derm with a shagreened surface. Beak four-segmented, nearly or quite attaining the hind coxae.

(Form with short tubercles, Plate 10, fig. 4). Differing from the above only in the shortness of the lateral tubercles which are almost obsolete in some specimens, though fairly well developed on the head, and in the shortness of the beak which attains or but slightly exceeds the hind coxae.

Alate female. Differing from the alates of *P. rileyi* and *P. davidsoni,* the only other species of which alates are available, in not having a constriction near the base of the third antennal segment (Plate 11, fig. 22) and in having but one large sensorium, the apical, on this segment.

Type Host and Locality. From *Castanea* in eastern United States.

Notes. The material examined is all from the National Collection and from the following hosts and localities: *Castanea vesca* and *C. pumila,* Washington, D. C.; *C. dentata,* Linglestown, Pennsylvania; "chestnut." Rockville and Annapolis Junction, Maryland.

Pergande suggests that the form with the long tubercles may be specifically distinct from the form with short tubercles. It will take further field studies to determine this point.

The nymphs of both forms have the dorsal tubercles developed but these are small and inconspicuous, being but little higher than broad.

Phylloxera sp.

Two slides from the National Collection, bearing the notation "Phylloxera castaneae Hald. No. Q. 13615 D. C. 8|31|17 Hst. chestnut, loc. Yarrow, Md., Coll. Dr. Galloway" contain alates of a species which is certainly not typical *P. castaneae* as they are much smaller and have the third antennal segment constricted somewhat as in *P. rileyi* and bearing two sensoria instead of one. The condition of the material and the absence of apterae, however, makes it inadvisable to describe the species.

EXPLANATION OF PLATES.

Plate 10.

Apterous agamic females of : 1-*Phylloxera querceti* Perg.; 3-*Phylloxera tuberculifera* n. sp.; 4-*Phylloxera castaneae* (Hald.), form with short tubercles, the small figure above showing a variation in the cephalic tubercles; 5-*Phylloxera rileyi* Riley; 6-*Phylloxera similans* n. sp.; 7-*Phylloxera davidsoni* n. sp.; 8-*Phylloxera castaneae* (Hald.), form with long tubercles, small figure above shows variation in cephalic tubercles; 9-*Phylloxera reticulata* n. sp. Fig. 2-ovipositor of *Phylloxera davidsoni* n. sp.

Plate 11.

Phylloxera castaneae (Hald.) : 1-alate female of form with long tubercles; 5-tubercles of form with long tubercles; 18-antenna of apterous female, form with short tubercles; 20-antenna of apterous female, form with long tubercles; 22-antenna of alate female. *Phylloxera stellata* n. sp.; 2-details of tubercles and integument; 8-apterous female; 15-leg of apterous female; 25-antenna of apterous female. *Phylloxera similans* n. sp.: 3-tubercle; 13-details of integument; 23-antenna of apterous female. *Phylloxera querceti* Pergande: 4-tubercle; 17-antenna of alate; 21-antenna of apterous female. *Phylloxera davidsoni* n. sp.: 6-details of tubercle and integument; 19-antenna of alate female; 26-antenna of apterous female. *Phylloxera rileyi* Riley: 9-details of integument; 14-tubercle; 16-antenna of apterous female. *Phylloxera tuberculifera* n. sp.; 7-details of tubercles; 10-details of integument; 27-antenna of apterous female. *Phylloxera reticulata* n. sp.: 11-tubercle; 12-details of integument; 24-antenna of apterous female.

NEW DIPTERA IN THE CANADIAN NATIONAL COLLECTION*

BY C. HOWARD CURRAN,

Ottawa, Ont.

Cyrtopogon willistoni new species.

Allied to *praepes* Williston but the first joint of the front tarsus is not silvery white pilose above.

Length, 11 to 16 mm. *Male*. Face strongly gibbose, convex-receding from a little below the antennae; moderately whitish-yellow pollinose; middle of face with tawny to yellow fine pile, bordered laterally with one or two rows of strong black hairs, all the hairs just above the oral opening stout and black. Front shining black in the middle, with a longitudinal groove, the sides yellow pollinose, the pile wholly black. Occiput black; black pilose, the immediate orbits wholly with a row of black hairs, the lower half with fine whitish yellow pile. Antennae wholly black, the basal segments with long black hairs; third joint longer than the basal two combined, coarctate basally, but wholly rather slender, its greatest width about the apical fourth or fifth; style one-fourth the length of the third joint, with a short, terminal spine-like process. The length of the antennae is about equal to the length of the face.

Thorax shining black, the 5 shaped brownish-yellow pollinose marking seldom complete, as the dash and lower portion is usually missing (usually present in large specimens, but not in the type); a slender or rather narrow median line on the anterior half of the same color and the posterior portion, when viewed from in front, with similar pollen. Pollen on the pleura similar in color to that on the dorsum; the scutellum with a richer colored pollen in certain lights, but generally appearing shining black. Pile moderately abundant, rather long, black; on the pleura chiefly yellowish, but almost all black on the meso- and sternopleura. Scutellum convex.

Legs black; hind tibiae sometimes quite reddish except the broad apex and very narrow base, at other times only slightly lighter in color on the basal two-thirds. Femora with rather abundant, long pale yellow pile, but behind, more or less, and apically, especially above, with black pile. Tibiae black pilose, the hind ones and sometimes the anterior four also, with yellow hairs in front. Anterior tibiae anteriorly and the hind ones on the apical fourth interiorly, golden tawny pubescent. Anterior tarsi with a long, silvery white crest on the last four joints, the hair parted anteriorly near the base, but not usually distinctly parted on the second joint; first joint black haired, rarely with just a few whitish hairs above before the apex; the last joint of the fore tarsus is longer than either the third or fourth, their ventral cushions tawny. Middle tarsi wholly black haired, the last two joints with anterior and posterior tufts of rather long hairs, the second and third with distinctly shorter tufts anteriorly, but the second may often be without the conspicuous tuft, the third joint usually has a small tuft behind; the fifth joint is nearly as long as the first. Hind tarsi simple; black pilose.

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* Contribution from the Entomological Branch, Department of Agriculture, Ottawa.

Wings cinereous or luteous hyaline. Squamae brown or brownish, with broad yellow border and sparse whitish fringe. Halteres yellow, the stem more or less infuscated.

Abdomen shining black, without pollinose spots or bands. Pile black; on the sides of the first two segments and the posterior angles of the two or three following, with yellow pile; this gives the appearance of tufts laterally. Sometimes the first three segments are wholly yellow pilose on the sides.

Female. Mystax rarely as in the male, usually much more blackish as the strong black hairs are scattered throughout the yellow ones; front more shining, beard paler. Thorax with the pollen yellowish on the middle of the dorsum, greyish laterally, the median stripe broader, entire, the 5 complete, usually wholly closed so that it resembles a 6; posterior portion of the thorax with greyish white pollen. Legs wholly simple; similar in colour. First to fifth abdominal segments with a roundedly triangular pollinose spot on the posterior angles, those on the fifth segment very small; the light coloured pile is usually less bright yellow.

Holotype, ♂, Chilcotin, British Columbia, June 16, 1920; (E. A. Buckell); No. 500, in the Canadian National Collection, Ottawa.

Allotype, ♀, Aspen Grove, B. C., June 28, 1922, (P. N. Vroom).

Paratypes, over 100 specimens from British Columbia and one specimen from Banff, Alberta.

Specimens were very kindly compared with the type specimens of *praepes* Will., in the Francis Huntington Snow Collection, University of Kansas, by Messrs. Wm. Brown and R. H. Beamer. Differences noted: In *praepes* the silvery pile extends to the base of the anterior basitarsi; the pad on the middle tarsi is limited to the last two segments. In *willistoni* there are seldom more than three or four short silvery hairs on the anterior basitarsi; the pad on the middle basitarsi always extends onto the third and possibly in good specimens onto the second tarsal joint.

This is the species described by Williston, (Trans. Am. Ent. Soc., XI, 12) immediately following *praepes,* but no name was applied. According to Brown and Beamer the specimens in the Snow Collection have been included under *praepes* as types, and there are altogether only four specimens. Including both species Williston had nine specimens when he drew up his descriptions, five of which were the present species, and it therefore seems probable that three of these are in other collections under the name *praepes.* Williston does not mention the pruinose spot on the sides of the fifth abdominal segment in *praepes* female, and says that the front tarsi in *praepes* are more slender than in the present species and the pollen on the thorax less extensive.

Cyrtopogon albitarsis new species.

Abdomen with reddish yellow pile forming dense apical bands; third antennal segment red; anterior tibiae and tarsi with a posterior fringe of short, silvery hair.

Length 11 to 12 mm. *Male.* Face moderately gibbose, convex receding, the pile golden yellow, below, and up the sides to the middle, stouter, black; ground colour obscured by pale yellowish pollen. Front yellow pollinose; wholly

black pilose. First two antennal joints black, with black hairs; third joint reddish yellow, constricted slightly just beyond the base; longer than the two basal segments combined, broadest about its middle; style usually black, but the base may be yellow. Occiput greyish yellow pollinose, black pilose; beard white, well separated from the eyes.

Thorax with a very conspicuous greyish yellow pollinose 5 on either side, the enclosed portion deep shining black, the margin behind the suture and a triangular projection inside the post-alar callus, also shining, elsewhere with greyish yellow or yellow pollen, the median line narrowly greyish in front on either side of which is a broader grey stripe; or the anterior curve of the five and the median geminate stripes may be ashy. Pleura yellowish grey pollinose. Pile black; on the propleura white, or the epipleura mixed black and golden. Scutellum convex with a golden brownish pubescence in some lights; pile black.

Femora all black, the apices narrowly yellow; pile black above, not very abundant, pale yellow below and behind. Tibiae reddish, the anterior ones paler, immediate base and apice black or blackish, anterior ones with moderately long silvery white pile posteriorly, short yellow pile anteriorly; a few black bristles exteriorly, several slender ones below anteriorly near the base and three below posteriorly, some of which may be reddish. Middle tibiae with silvery white pile in front and exteriorly, yellow pile elsewhere; with numerous black bristles. Hind tibiae wholly black pilose, the end below golden pubescent. Anterior tarsi yellow, with silvery pile which forms a dense fringe posteriorly; on the basal two segments the pile is bright yellow anteriorly. Pile all white on middle tarsi, which are darker than the anterior ones but paler than their tibiae. Hind tarsi with black hairs, in colour, similar to the middle tibiae.

Wings sometimes slightly tinged with luteous apically. Squamae fuscous with whitish border and fringe.

Abdomen black; second, third and fourth segments each with a posterior silvery greyish pollinose band, which appears yellow beneath the pile. First four segments reddish or tawny pilose, sparser and shorter anteriorly so that the pile appears in broad bands. Fifth, sixth and seventh segments triangular when viewed from behind, black pilose: with a narrow transverse band of short black pile about their middle dorsally, the last one or two segments with a steel blue reflection on the "keel." Hypopygium black; with a conspicuous fringe of black hairs sub-basally.

Holotype, ♂, Banff, Alta., July 17, 1916, (C. G. Hewitt); No. 501, in the Canadian National Collection, Ottawa.

Paratype. ♂, Banff, Alta., July 23, 1909, (N. B. Sanson).

Odontomyia alberta new species.

Allied to *cincta*, but the branch of the third vein is at the apical fourth and not just beyond the middle; the frontal triangle is larger and black; abdominal crossbands shorter and scutellum broadly black basally in the middle; femora black apically; female with similar abdominal markings; front black, yellow just above the antennae; with a yellow oval spot on either side about the middle and sometimes two smaller spots between them; immediate vertex usually yellow, at least with two small spots.

Length 11 to 14 mm. *Male.* Face and cheeks pallidly green or yellow; above with four short forks of black extending from the black about the base of the antennae; the lateral forks along the orbits the median at either side of the rounded carina; sometimes more or less diffuse shining brownish in the middle of the upper half. Carina broader above, rather flat, face receding, only a little more prominent above than at the antennae. Frontal triangle shining black with a bluish cast, with a yellow, narrow longitudinal groove. Pile of face and front moderately abundant, fine, whitish. Vertical triangle shining black, dull in front; ocelli whitish; with short rather tawny pile, pile of vertex longer, yellowish or whitish. Occiput black above, not visible from above on either side of the vertex as the eyes extend back and down; below concolorous with the face; below with rather silvery pubescence directed towards the eyes. Antennae black, second and third segments opaque brownish with numerous round black areas; sometimes the apices of the first two joints and base of the second and third obscure luteous; first joint longer than the second; first annulus about as long as the first joint; third joint pointed apically. Facets of the eyes enlarged from a line about the length of the first antennal joint below the base of the antennae.

Dorsum of thorax shining blue black, the sides more bronze black in some lights; pile rather tawny but appearing whitish in most lights; postalar calli, usually extending almost to the roots of the wings, yellow or green; pleura greenish or yellow, with pallidly yellowish pile; pectus black, the black extending as a lobe onto the lower part of the mesopleura; scutellum concolorous with the thorax; the margin not reaching the basal angles, yellow or green, this colour somewhat expanded sub-basally; spines long, their bases yellow, apical half brown. Pile on the sides of the scutellum, bright yellow; elsewhere whitish.

Femora yellow or greenish; the apical half of the anterior four black; their apices reddish; apical third of the hind ones reddish brown; coxae green; tibiae black, the basal fourth yellow; tarsi brown.

Wings hyaline; veins brownish yellow; thin veins almost hyaline; cross-vein in the apical portion of the submarginal cell, situated at the apical fourth. Squamae white, with white fringe; upper lobe a little infuscated. Halteres with apple green knob, the basal half of the stem fuscous.

Abdomen subopaque steel blue; or often almost opaque black, with the fifth segment largely shining; sides of the first segment rather broadly, broad, rounded triangles on the second segment, resting on the hind margin, their inner ends narrowly separated from the margin, and in front separated from the lateral margin by the same distance as the green on first segment; slightly less broad markings on the third segment, their anterior margin not quite, or quite, reaching the margin inside the anterior angles; small rather truncate, longitudinal spots inside the posterior angles of the fourth segment and the conspicuous margin of the fifth, green or yellow; the margin of the fourth segment on the posterior two-thirds is green and is connected posteriorly with the green spot; the third segment may be said to be green laterally, more broadly so behind, with a blackish spot inside or almost upon the anterior angles, which stretches inwards, often to meet the black ground colour. When visible the sixth segment is green with a black arch in the middle, its curve caudad. Pile short on the disc, rather tawny;

a conspicuous patch of pile on the fifth segment, laterally; basal pile of abdomen longer, and paler; venter wholly green or yellow, with short rather silvery pile.

Female. Very similar to the male. Face yellowish; about the antennae with a roundish blackish area which emits a blackish stripe towards the orbits on either side; above the antennae narrowly yellowish; above which the ground colour is shining black; an oval spot on the orbits about the middle, a smaller spot inside these and a pair of spots on the vertex, never reaching the yellow orbits but often contiguous at the middle, yellow; sometimes all these spots small and the inner ones on the front wanting. The ocellar triangle is situated in a distinct depression and the median groove is deep. Occiput yellow to the upper angles of the eyes.

Thorax with the sides yellow or green, always a projection just behind the humeri and an elongate one along the lateral suture in front of the dorsal suture. The black of the pectus does not extend onto the mesopleura, but there may be an irregular brownish patch below. Scutellum usually all green or yellow except the base, which emits a rounded projection cauded at the middle; spines wholly greenish or yellow but the tips may be fuscous.

Abdominal spots all smaller; those on the first segment wider posteriorly; on the second narrower anteriorly, the posterior projection quite angular and occupying about one-fourth the width of the segment; spots on the third segment occupying a little over the posterior half at the widest portion; about one-half at the margin, the inner end angular; spots on fourth segment smaller, occupying about one-third the length of the segment. On the third and fourth segments the lateral margin is black on the anterior half; the spots on the third and fourth segments are widest at their middle.

Holotype, ♂, Banff, Alta., August 25, 1922, (C. B. Garrett); No. 502, in the Canadian National Collection, Ottawa.

Allotype, ♀, same data.

Paratypes, 9 ♂, 1 ♀, same data, 4 ♀, Banff, Sept. 15, 1922; 1 ♀, Banff, Sept 15, 1922; all collected by C. B. D. Garrett. ♂ Banff, ♀ Banff, Aug. 1, 1906; and ♀ Banff, Aug. 8, 1911, collected by N. B. Sanson.

Stratiomyia discaloides new species.

Allied to *discalis* Loew but the second ventral segment is black with a narrow basal and an interrupted apical fascia broadened at the sides to occupy practically the whole length of the segment, the legs are black pilose, the scutellum with decidedly less dense pile than the thorax, the face more receding, etc.

Length, 14 to 15 mm.; width of abdomen 7 to 8 mm. *Male.* Head entirely shining black. Pile pallid, more yellow on the face above, golden between the eyes, black on the ocellar triangle. Face receding, with a concavity at the upper fourth, the carina rather broad, rounded; slopes transversely rugulose, the sides, upper portion and cheeks more shining. Front with a deep, narrow longitudinal foevea. Eyes not quite touching, bare. Antennae black, last two joints opaque; third joint one-third longer than the first, second short; pile of first two joints black. Mouth parts brownish black, with yellow hairs.

Thorax and scutellum shining blue black, the latter with its margin inside the spines yellowish, but the apex in the middle black; spines moderately long,

sharp, yellow. Pile on the thorax yellowish greyish, dense on the dorsum, thin on its apex and on the scutellum.

Legs black; narrow apices of the femora, basal fourth of the tibiae and all the tarsi reddish yellow; tarsi brownish on the last two joints. Pile of femora black, elsewhere yellow.

Wings slightly infuscated; veins mostly olive luteous, a few brownish. Stigmal cell clearly defined, pallidly yellowish. Squamae brown with dense, long, whitish fringe. Halteres greenish, the base yellowish.

Abdomen shining blue black, with rather conspicuous black pile; on the sides of the second segment except anteriorly and on the lateral margin of the fourth and fifth and broad apex of the latter, whitish. First segment wholly black; second on the sides with a subquadrate yellow spot, distinctly broader behind, its longitudinal length distinctly greater than its width; side margins of the third segment on the basal half and a sub-oval or orbicular spot not quite touching the base except laterally, yellow; the narrow apex of the third and lateral margin of the fourth on the basal fourth, and similar but smaller markings on the incissures of the fourth and fifth, whitish yellow; a small roundish spot at the apex of the fifth segment. Venter black; narrow base of the second segment and a pair of transverse, narrowly interrupted, subtriangular spots occupying the entire length of the segment laterally, longitudinal subrectangular spots on the sides of the third, their inner ends rounded, and the narrow apices of the third and following segments, yellowish. Pile of the venter black, except on the yellow markings.

Female. Face more shining, as it is punctured rather than rugose on the slopes, the depression on the upper fourth absent; carina more rounded; front black, with a sub-cordate yellow spot below the ocelli; ground roughened by four or six broad, rather longitudinally placed, densely punctate depressions, polished across just above the antennae; ocellar triangle not prominent; occiput narrowly yellow along the eyes on the lower half. Pile wholly pale.

Abdomen with the sides of the third segment, expanding a little anteriorly and posteriorly, and the narrow sides of the fourth, extending narrowly inwards along its posterior margin, reddish yellow; fifth segment with a narrow median yellow line on its apical three-fourths and the narrow apex of the same colour.

Holotype, ♂, Chilcotin, British Columbia, June 4, 1920, (E. R. Buckell); No. 503, in the Canadian National Collection, Ottawa.

Allotype, ♀, Chilcotin, June 10, 1920, (E. R. Buckell).

Paratype, ♀, Kelowna, B. C., July 2, 1914, (M. H. Ruhman).

This species is very distinct from *discalis* and *quaternaria* and is most readily distinguished from both by the colour of the venter, pale markings, etc. The fringe on the squamæ of the latter is less dense and there are patches of black hair on the thorax, the antennae are speckled with brownish and it is more compact and thicker. *S. discalis* is also more compact, the second ventral segment is wholly yellow, the margin of the scutellum usually all yellow and the first antennal segment longer, especially in the female. The arrangement of the veins about the stigmatal area is also quite different.

Stratiomyia velutina new species.

Allied to *discaloides* but the pile is shorter, paler and much more dense on the dorsum of the thorax, the ventral yellow bands complete and slightly broader and the pile on the squamae not so abundant.

Length, 13 mm.; width of abdomen 6 to 6.5 mm. *Male*. Head shining black, with pallid greyish white pile, that between the eyes and on the occipital triangle black. Face receding, roundedly carinate. Antennae black, pile on the second segment golden brown and black.

Thorax and scutellum shining blue-black, the ground color almost obscured by the very dense, moderately short dirty whitish pile. Spines of the scutellum and a very short dash along the margin apically from their base, yellowish; spines moderately long and sharp. Wings as in *discqloides*. Squamae with the lower lobe more pale.

Abdomen almost as in *discaloides* but decidedly narrower and more convex, still less convex than in *discalis*. Yellow spot on the second segment, subtriangular, its inner side somewhat rounded, especially in front, the spots as wide posteriorly as long; spot on the third segment broadest sub-basally, one-third or less as wide as the preceding, gradually tapering, and extending narrowly inwards along the posterior margin for a short distance. There may be a linear angle on the posterior angle of the fourth and anterior lateral margin of the fifth segments. The narrow apex of the fifth emits a linear projection forward in the middle to about one-half the length of the segment, but in the paratype this is represented by an apical triangle which is very small. Pile black; basally and on the sides of the second and third segments, except the base of the former, sometimes on the whole side margin beyond the base of the second segment, and the moderately narrow or wide apex of the fifth segment, yellowish. Venter black, all the segments with conspicuous yellow apical bands, successively narrower towards the apical segment; sides of the second and third segments of the same colour, the third segment more broadly yellowish behind.

Holotype, ♂, Aspen Grove, British Columbia, June 15, 1922, (P. N. Vroom); No. 504, in Canadian National Collection, Ottawa.

Paratype, ♂, Lillooet, B. C., May 24, 1917, (A. W. A. Phair).

Pipiza atrata new species.

Entirely black pilose except the eyes and a few hairs on the femora basally.

Length 8 mm. *Male*. Face receding; shining metallic bluish black, thinly covered with whitish dust; with rather stout, abundant black pile; bluish black in ground colour. Vertical triangle and occiput shining black, with black pile. Eyes with brownish pile. Antennae black, third joint brownish, subcordate, longer below. Arista black.

Thorax and scutellum shining bluish black, with black pile. Squamae with white fringe.

Legs black; tips of all the femora, basal third of the anterior four and fifth of the hind tibiae and the extreme tips of the anterior four yellow. Tarsi brown, the tips and bases of the basitarsi very narrowly yellowish. Hind femora slightly thickened, without angular projection.

Wings hyaline, slightly yellowish in front; last section of fourth vein parallel to wing margin, straight.

Abdomen shining blue black; black pilose. Venter with long pale pile.

Holotype. ♂. Chilcotin, B. C., June 18, 1920. (E. R. Buckell); No. 505, in the Canadian National Collection, Ottawa.

This species is very distinct from all others known to me. It traces out to *nigripilosa* in my key (Proc. Cal. Acad. Sci. XI, 374) but is readily separated by the entire absence of brownish pile, broader, steel blue abdomen, and much shorter third antennal joint.

Cnemodon nigricornis new species.

♂. Hind trochanters and middle coxae with processes; antennae wholly black; legs black, bases of tibiae narrowly and first two or three joints of front four tarsi yellow. ♀. Third antennal joint very large, oval, reddish below on basal half; pile of venter short, erect.

Length 5 mm. *Male*. Face evenly receding; black pilose on the sides and below, white pilose in the middle; frontal triangle rather large, moderately swollen, greenish black, with a greyish sheen, not opaque above; black pilose. Vertical triangle and occiput shining black; the former in front and the latter on the upper half black pilose, elsewhere yellowish or white pilose. Antennae wholly black; third joint a little longer than broad, longer below, the apex sub-truncate. Arista black. Eyes with short yellow or fulvous pile.

Thorax shining black, whitish pilose; pleura above and apical half of scutellum with brown or black pile.

Legs black; very narrow tips of the femora, narrow bases of the tibiae and the first three joints of the front four tarsi yellow; the front tarsi a little infuscated on the basal three joints. Middle tibiae gradually increasing in width to apical third, where it is suddenly narrowed; processes on hind trochanters rather short, of usual shape, pale on apical half.

Wings cinereous hyaline, last section of the fourth vein curved before basal third; last section of fifth vein almost straight.

Abdomen with the usual opaque and shining areas, and the usual arrangement of black and white pile.

Female. Face moderately wide, wholly white pilose, the orbits narrowly whitish pollinose, not expanding below the antennae, but continued to the lower third of the front where they expand slightly; front wide, black pilose on lower third and across the ocelli, elsewhere white with a yellow tinge. Posterior orbits with whitish pile and black ciliae. Antennae black; second joint on the inside and the third below on basal half, reddish yellow; third joint large, oval, the apex obtuse; arista black.

Thorax shining black; wholly white pilose. Squamae and halteres whitish. Wings hyaline, venation as in the male. Stigma pallidly yellowish.

Legs black; apices of the femora, broad bases and apices of the anterior four tibiae, narrow base of the hind ones, and first two joints of the anterior four tarsi, yellow. Pile wholly white. Middle tibiae broadened anteriorly.

Abdomen shining black; white pilose; narrow apical margins of the second and third segments with short black pile. Venter with sparse, short, erect white pile.

Holotype, ♂, Banff, Alberta, June 15, 1922 (C. B. Garrett); No. 506, in the Canadian National Collection, Ottawa.

Allotype, ♀, same data.

This species is related to *calcarata* and *elongata* to which it traces in my key, although it might possibly trace to *cerealata*. It differs from the two former by its wholly black antennae and wholly shining, slightly larger front, shorter processes on the hind femora, and pile on the upper portion of pleura and scutellum. From *cerealata* it is distinguished by the differently shaped trochantral processes, colour of pile on pleura, more slender form, etc. The large, broadly oval third antennal joint and wing venation are characteristic for the female, but identification of this sex is almost impossible. The female traces out to *placida* but is readily distinguished by the small frontal pollinose spots, larger antennae, etc.

Dolichopus vanduzeei new species.

Length 3-5 to 4 mm.; of wings, the same. *Male*. Face moderately narrow; a little wider above; brownish yellow: Front green or green blue, the sides bronze. Antennae wholly black; third joint twice as long as broad, the apex rather acute; arista situated well before the apex. Orbital ciliae wholly black.

Thorax green, not much shining, the dorsum with a longitudinal darker geminate stripe: in front thinly greyish pruinose. Pleura greyish pruinose. Abdomen green with bronze reflections, the sides noticeably greyish pruinose. Hypopygium black; lamellae brownish grey, the border black; triangular, as broad as long, the apex with about six teeth, the lower ones larger, with fine black hairs above and below. Coxae black, the front ones with yellowish grey pollen and black hairs on their anterior surface. All the femora black, their apices yellow; hind ones not ciliate below; middle and hind femora each with two preapical bristles in front. All the tibiae yellowish, the apical sixth of the hind ones brown or black, middle ones with one bristle below, near the apical third. Tarsi black, the front four basitarsi more than half yellow; middle basitarsi without a bristle above. Ciliae of colypteres black.

Wings greyish hyaline; last section of the fourth vein with a slight curve beyond the basal third; costa with an elongate tapering swelling at the tip of the first vein. Hind margin scarcely notched at tip of fifth vein, almost rounded.

Female. Face wide; greyish on the lower half, yellow above; sometimes wholly ochreous. Third antennal segment only a little longer than broad, the arista almost apical; abdomen more inclined to be cupreous bronzed.

Holotype, ♂, Banff, Alberta, May 5, 1922 (C. B. D. Garrett); No. 507, in the Canadian National Collection, Ottawa.

Allotype, ♀, same data.

Paratypes, 8 ♂, 2 ♀, same data; 1 ♀, Aug. 1, 1922, same locality and collector.

The male of this species traces out between *intentus* and *gratus* in the Van Duzee, Cole and Aldrich key. It is distinguished from *intentus* by its ochreous face and from *gratus* by the long third antennal joint. The female traces out to *nubifer* in the same key, but that species has a white face as has also the female of *gratus*. Legs wholly simple.

I take pleasure in naming this species in honour of Mr. M. C. Van Duzee.

Dolichopus albertensis new species.

Length almost 5 mm., wing 4.5 mm. *Male.* Face rather narrow, a little wider above, white. Front bluish green to blue not strongly shining, the sides narrowly opaque. Antennae wholly black, third joint short oval, its apex narrower, more pointed above, the arista inserted beyond the middle, bare. Proboscis and palpi brown, the edge of the former usually narrowly yellowish. Orbital ciliae wholly black.

Thorax deep green, not very shining, with four more or less distinct, narrow eupreous lines, sometimes with a slight bronze reflection. Pleura brighter green, more brassy, the metapleura blackish, thinly covered with greyish white pollen. Abdomen greenish with a brassy reflection, incisures darker, first two segments sometimes bluish, their bases laterally darker, purplish brown. Hair all black. Hypopygium black; lamellae black, excluding the stem, rather square, its apex jagged; with four short teeth, wholly fringed with sparse, rather long stout hairs.

Legs simple; wholly black, the knees very narrowly yellowish, the extreme apex of the front tibiae sometimes yellowish. Front coxae on their anterior surface with whitish luteous pollen and black hairs which are rather long. Middle and hind femora each with two preapical bristles, the latter not ciliate but with a row of conspicuous black hairs on the lower inner edge on the basal half or more and with slightly longer hairs on the lower outer edge. Hind tibiae a little stout; on the under side with a row of short, rather stout black hairs ending at the long bristle; hair on all the tibiae wholly black. Fore tarsi a little longer than their tibiae, the first joint about equal in length to the three following, the last segment slightly longer than the fourth. Middle basitarsi without a bristle above. Calypters and halteres yellow, the ciliae of the former black, abundant.

Wings greyish hyaline, the costa a little swollen before the tip of the first vein, hind margin conspicuously indented at the tip of the fifth vein; a shallow sinus between the fifth and sixth veins, the anal angle a little prominent.

Female. Face broader, silvery white; third antennal joint slightly shorter. Front darker, sometimes bluish. Abdomen usually with bronze reflections.

Holotype, ♂, Banff, Alta., June 18, 1922, (C. B. D. Garrett); No. 508, in the Canadian National Collection, Ottawa.

Allotype, ♀, same data.

Paratypes, 6 ♂, 5 ♀, same data; 1 ♀, Banff, Alta., July 8, 1922, (C.B.D. Garrett).

This species is related to *D. barbaricus,* but is readily distinguished by the bright coloured pleura, absence of long hairs on the lower, inner side of the hind femora, bluish green front, and absence of brownish colour just below the antennae. The male hypopygium appears to differ in shape. Differs from *D. picipes* of Europe in that the venter is not grayish and in the presence of a costal swelling.

Dolichopus diversipennis new species.

Length almost 6 mm.; of wing the same. *Male.* Face wide, slightly narrower below; dull golden brownish. Front deep shining blue, the middle violet. Antennae wholly black, the first joint shining, second and third sub-shining;

third joint orbicular, its upper apex pointed, apparently a little broader than long; arista inserted a little before the apex of the third joint, the basal portion over one-third as long as the apical joint. Orbital ciliae black, those on the lower half pale yellow.

Thorax deep green with a brownish cast; a geminate median longitudinal brownish stripe. Pleura and anterior of the dorsum with greyish pollen, the pleura brighter green than the dorsum, with more or less bronze reflection. Abdomen green, with bronze reflections, the sides thinly whitish pollinose. Hypopygium black, with thin whitish dust; lamellae large, elongate oval, the lower apex angular, the upper broadly rounded, in colour dirty yellowish, the border black, the apex jagged,with six rather long projections. Legs simple. All the coxae black, with grey pruinosity, the anterior surface of the front pair with short black hairs. Front femora black, about the apical sixth yellow; middle and hind femora reddish yellow, the former with a ventral black streak on the basal half, the latter with a similar streak on the basal third and the apical fifth, not meeting below, black; with a greyish pruinosity. Tibiae yellow, the middle ones a little swollen apically, the hind ones rather stout, their apical fifth black. Fore tarsi plain. All the tarsi black, the front four metatarsi reddish yellow except their apices. First joint almost as long as the remainder combined, the fourth and fifth joints of equal length. Middle and hind femora each with three preapical bristles in front; the latter with long black ciliae which are longer than the greatest width of the femora. Middle tibiae with one bristle below. Middle basitarsi without a bristle above. Calypters and halteres yellow, the former with abundant, long black ciliae.

Wings hyaline, with a diffuse brown spot beyond the crossvein between the fourth vein and the costa and narrowly on the crossvein, the spot darkest between the costa and third vein. Costa with a conspicuous elongate enlargement before the tip of the first vein, gradually narrowing beyond the vein. Last section of fourth vein moderately bent at its basal third, the third vein curving noticeably towards it apically. Hind margin a little indented at tip of fifth vein, scarcely, broadly so at tip of sixth.

Holotype, ♂, Nordegg, Alberta, July 5, 1921, (J. H. McDunnough); No. 509, in the Canadian National Collection, Ottawa.

This species must be very close to *D. partitus,* but may be distinguished by the more extensively yellow legs, the broader, more pointed antennae, the broader lamellae, which are more squarish basally and the costal swelling which seems to be a little larger. In Van Duzee, Cole and Aldrich's Key it traces out to *bryanti,* but is readily distinguished by the maculated wings.

A NEW WESTERN CATOCALA (LEPID.)*

BY J. MCDUNNOUGH,

Ottawa, Ont.

For the past few years we have been receiving considerable material in this group of moths from our Lethbridge laboratory; besides *verecunda* Hlst., occasional specimens of the Albertan form of *pura* (which incidentally is intermediate between Eastern *semirelicta* and typical *pura*) and an odd *unijuga*, the sendings were largely made up of specimens which I fail to place under any known name; they approach closest to *meskei* Grt. and may eventually prove to be a race of this species. Until, however, we know the life histories of both species more fully, I propose to treat it as a new species with description as follows:—

Catocala orion n. sp.

Thorax and primaries a pale bluish gray, shaded considerably with blackish; the latter rather narrow and with the dark shading most evident at the base of the wing in the submedian area, around the reniform, between the t.p. and s.t. lines and as an oblique dash below apex of wing. Basal half line black, forming small patch on costa; t.a. line geminate, white filled, very irregularly dentate, with deep inward angulations on cubitus and vein 1; beyond it on costal portion of wing an oblique whitish shade including the subreniform; reniform of usual shape, lunate, with outer margin somewhat dentate; t.p. line black, bordered outwardly with white, very strongly dentate with a prominent reentrant angle on vein 1; subterminal space slightly tinged with brown but mostly obscured by dark shading; s.t. line white, strongly dentate, bordered outwardly by blackish, subparallel to t.p. line, the black ends of the teeth at times almost touch the broken black terminal line; fringes pale, marked at ends of veins by black. Secondaries pale pinkish-red, much as in *meskei*, with the usual dark median and terminal bands, the former not attaining anal margin of wing, latter enclosing a flesh colored apical spot and slight pale spots along termen of wing, which give the outer margin of band a crenulate appearance; fringes whitish. Expanse 65—70 mm.

Holotype—♂, Lethbridge, Alta., Aug. 31, (H. L. Seamans); No. 550 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality, Aug. 25, in the Canadian National Collection, Ottawa.

Paratypes—2♂, 2♀, same locality, in Canadian National Collection, Ottawa.

As is so often the case in this group the species occurs in two forms; the typical form, as above described, has rather contrasted maculation of primaries with a more or less evident dark shade through the submedian fold; in the second form the dark shading is obsolescent and the primaries are rather even blue-gray with less contrasted maculation. For this form the name **concolorata** may be used; the types, No. 551, in the Canadian National Collection, are six specimens (3♂, 3♀) from Lethbridge, bred or captured on various dates in August.

Mr. Seamans informs us that the larva feeds on cottonwood and is deep gray in color with well-marked subdorsal and lateral dark bands.

* Contribution from the Entomological Branch, Dept. of Agric., Ottawa.

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POPULAR AND PRACTICAL ENTOMOLOGY

The Life Habits Of Cephus Cinctus Nort. In Manitoba.*

BY NORMAN CRIDDLE,

Treesbank, Man.

The problem of controlling the Western Wheat-stem Sawfly, *Cephus cinctus*, is still an acute one in the Prairie Provinces. The insect is now found over more than half the wheat-growing area of Manitoba; its range is very wide in Saskatchewan and it has been found to be present over quite an extensive territory in Alberta.

During the year 1922 the infestation was particularly severe, it being by no means uncommon to find fields of wheat with ninety per cent. of the stems attacked. Indeed, thousands of acres were similarly infested and countless millions of larvae remain in the stubble at the present time which will develop into adults next June, preparatory to attacking the new crop.

Much has already been written concerning this sawfly, but as further observations were made during 1922 in which additional information was obtained, it seems well to review the more important facts of the insect's life-history at this time.

The following summary shows the life cycle of the insect as it occurred in 1922:

Pupation began	May 20	completed May 28.
Adults appeared	June 9	abundant by the 12th
Mating began	June 10	general by June 12
Egg laying began	June 12	general by June 14.

In seeking a spot in which to place her eggs, the adult female sawfly runs actively up and down the stem with her head close to it as if making a careful examination for the right place; finding a likely one, she faces downward, and drawing her abdomen under her, thrusts her saw-like ovipositor into the stem in order to locate a hollow. Should this not be present, she tests other places until eventually, finding one that suits, she deposits an egg within the stem—a shiny, cylindrical white object, not very easily seen. In depositing eggs, a preference is shown for a situation around the topmost joint, but it frequently happens that there is no hollow at this point, in which case a lower position is selected. Thus there may be eggs in any portion of the stem. There appears to be an attempt of individual flies to place only one egg in a stem, but after searching among the neighboring herbage it is not an uncommon occurrence for the insect to return to the original plant and place another egg in it. The process of egg-laying only takes a few seconds, though the time occupied in seeking a suitable place may take several minutes. On one occasion an individual was seen to thrust her

*—Contribution from the Division of Field Crop and Garden Insects, Entomological Branch, Dept. of Agric., Ottawa.

ovipositor into a stem fourteen times, seven times almost exactly in the same spot. Eventually, after nine minutes, she placed an egg just above the top joint.

Apparently there is no limit to the number of eggs that may be deposited in a single stem by a series of sawflies, as each is unconscious of the ones that preceded it. It is a common event to find two or more, and I have twice located thirteen eggs in one stem. Thus it happens, as is so often the case in nature, that many are sacrificed for the sake of one, for of all the eggs that are deposited and of the larvae that hatch from them, but one survives.

The selection of suitable plants for egg-laying is governed by the state of growth of the plants. First of all it is necessary that there should be a hollow place in the stem in which to place the egg; secondly, a stem is desired that is succulent in order that the sawfly may work her ovipositor in easily, and of a kind which provides the larva with tender food. Reasonably well advanced wheat is generally in exactly the right condition for oviposition, but when wheat is not ready the flies seek other plants instead. It is largely on this account that fall rye is often heavily infested with eggs. Two native grasses, *Agropyron smithii* and *A. richardsoni,* which constituted two of the original host plants, are always heavily attacked. I have found no exception to the rule that any plant of the grass family provides a harbor for eggs supposing it is in the condition specified above. We found in 1922 that oats, both wild and cultivated, which were supposedly immune, contained eggs when the plants were sufficiently advanced and early sown barley was severely infested.

While the female sawfly shows little discrimination in placing her eggs within the various stems, it is an interesting fact that some of these plants are quite unsuitable to larval development. Brome grass, for instance, is particularly utilized for ovipositing in, but of the larvae thus started on their career, not more than one per cent, on an average, attain maturity. Oats are still more resistant, and we have yet to find mature larva in their stems. It is interesting to note that the causes for the high death rate in oats and brome grass are partly due to different factors. In oats, the cause seems to be excessive sap which drowns the larvae, while in brome grass there is a combination of causes among which are parasites, but more usually it is the late ripening of the stems, which seems to mystify the larvae as to when and where to cut them, so that in many cases they die without doing so at all.

Of the numbers of larvae that frequently hatch in a stem, the first to do so generally survives. This larva quickly tunnels the plant, and as it does so, destroys any eggs or larvae that may be met with. As a rule the lowest situated larva seems to have an advantage over those higher up. It is quite a frequent event to find two or more larvae in a stem, but these, after the first week or two, are always separated by a joint, and so soon as this partition is tunnelled, the stronger larva destroys the other.

Larvae in feeding work both up and down. They may attain the base of the plant in eight days, but they soon work up again, and it is not until the end of July that they are ready to sever the stem and go into winter quarters. It is at this stage that a very important factor comes into play insofar as the farmer is concerned. While the larvae are ready to sever the stems in late

July, they are governed in doing so entirely by the condition of the plants they inhabit. Should these stems dry through immature ripening, the larvae quickly make their way to the base of the stems and cut them, but should the stems ripen gradually or remain green for three weeks later, the larvae will postpone their preparations for winter until the stems eventually lose their sap. Thus there may be a difference of fully three weeks in the time of severing the stem, due entirely to the difference in maturity of the plants. This fact, which has already enabled farmers to save millions of bushels of wheat by cutting ahead of the sawfly, will prove still more effectual when it is taken advantage of by the whole growing communtiy.

As now known, the various stages of the insect's life may be summarized as follows:

Egg stage	8 days	oviposition period	33 days.
Larval life	333 days	larval period	345 days.
Pupal stage	16 days	pupal period	22 days.
Adult life	16 days	adult period	32 days.

It seems hardly necessary to add that these figures are approximate, there being a variation due to meterological and other factors.

The Wheat-stem Sawfly was originally held in check by its natural enemies, and it is still held under control by these in grasses other than grains. Of these enemies, Hymenopterous parasites are by far the most important and so numerous have they been that in 1921 infested grasses were found to be approximately 60 per cent. parasitized and, in 1922, *Agropyron* and *Bromus* showed a *Cephus* destruction of 85 per cent. due to parasites. Our chief ally in thus destroying the sawfly larvae has been *Microbracon cephi,* a species collected originally by Mr. C. N. Ainslie of the U. S. Bureau of Entomology. Other parasites have been reared, but as yet they have not been of very great service.

While the above mentioned parasites effectively control the sawfly in grasses, they have, unfortunately, made little or no headway in advancing into the grain fields, be the cause what it may. One reason, however, seems to be the cultivation of the soil for crop. In the case of *Microbracon* there is cause to suspect that cutting the crop is an important factor. There are two generations of *Microbracon cephi;* adults from the first generation appear in late June while those of the second generation do so in early August. The last date is about harvest time, and it is soon after this period that the parasites commence their egg laying. It has been noted that the parasite runs actively up and down the stem when in search of the larval host within, and that she avoids broken or cut straws. It is possible this is why the larvae in the stubble remain unmolested. The fact remains that there is a certain amount of parasitism in wheat during July, but no sign of it in the later generation which should be apparent from September of one year to June of the following year.

CONTROL.

Very little has been added to our previous recommendations excepting that further experiments show the absolute necessity of packing spring plowing in order to prevent the sawflies emerging. Fall plowing as soon as possible after harvest is much better, because the soil packs naturally during winter, and in ad-

dition, the moisture in the soil tends to rot the stubs, which aids in destroying the larvae.

As regards trap crops, our experiments show considerable promise. In 1922 a strip of wheat sown between the previous year's stubble and the new crop, contained, on an average, rather more than four sawfly eggs to a stem, while the field which this strip was sown to protect, averaged slightly more than one egg to a stem on the edge of the field and less towards the centre. The trap strip in this instance was sown rather late and it was not, therefore, as attractive to the sawflies as it might have been had it been sown a week earlier. This was demonstrated by the fact that the more developed stems contained far more eggs. One strip, however, is not sufficient on a large stubble field; at least three are necessary.

The season of 1922 was particularly favorable for showing the advantage of harvesting before the crop had fully ripened. As had been pointed out above, the sawfly larvae do not cut the stems until they have lost the major portion of their sap, or, in other words, until the straw begins to dry. By cutting slightly in advance of this time the grain can be harvested without loss or shrinkage. Fields frequently noted in 1922 which had been cut "on the green side" were free from loss, while adjoining fields cut too late had suffered a loss which varied from three to fifteen bushels per acre.

It is well to remember, however, that early cutting does not kill the sawfly larvae, nor is it always effective in preventing all loss, because the weakened stems may be blown down and broken by storms considerably in advance of cutting time. Rust may also kill the plants prematurely, but on the whole, the practice of early harvesting is extremely effective and it cannot, therefore, be too strongly recommended.

A NEW MOSQUITO FROM BRITISH COLUMBIA (CULICIDAE, DIPTERA)*

BY ERIC HEARLE,

Vernon, B. C.

In August, 1919, while undertaking a survey of the mosquito fauna of the Lower Fraser Valley, the writer took some small, ring-legged *Aedes* at Yale, B.C. In no other locality in the territory embraced in the survey was this species encountered; but at Yale it was the only species at all common—it was evidently adapted to the canyon conditions obtaining at this place. Only females came to hand, and an accurate determination was not possible at the time, but the specimens appeared smaller than any of the known members of the *excrucians* group to which they evidently belonged. A trip to Yale on July 19th, 1920, was rewarded with several males taken feeding on white spiræa at dusk. These were tentatively placed as small specimens of *Aedes increpitus* Dyar, but a recent more careful examination of the genitalia indicates that they lie intermediate between *Aedes mutatus* Dyar and *Aedes increpitus* Dyar, and are distinct, although coming very close to the above two. According to Dr. Dyar's keys, *Aedes mutatus* Dyar has the filament of the claspette expanded towards the base, and *Aedes increpitus* Dyar has the filament expanded beyond the middle, whereas in the present species the angular expansion of the filament is exactly at the middle. I

*—Contribution from the Entomological Branch, Dept. of Agric., Ottawa, Ont.

propose the name *Aedes hewitti* after the late Dr. C. G. Hewitt.

Aedes hewitti new species.

Female. Integument brownish black. Proboscis and palpi clothed with brownish black scales. Head with yellowish white flat scales, broad at cheeks; erect, forked white scales at nape; small patch of broad, dark scales at sides; bristles bordering eyes black, forward projecting ones at vertex pale. Prothoracic lobes with yellowish white scales and pale bristles. Mesonotum clothed with small, shining, dark brown scales centrally and sub-dorsally; and large, dull, dirty white scales at the sides, the anterior margin, and the border of the ante-scutellar space; bristles dark brown. Abdomen with dark scales dorsally and each segment with a concrete basal band of creamy white scales; up to fifth segment bands somewhat expanded medianly; bands on fifth to seventh segments widened triangularly at sides; first segment clothed with a patch of creamy white scales and many white hairs; cerci black; venter clothed mostly with dull white scales, a few black ones intermixed, especially along the median line. Wings dark scaled except for a few pale scales along the costal border. Halteres entirely pale. Legs with black and white scales intermixed; evenly on outside of femora, but with white predominating on inside and black towards apex; tibiae largely black scaled except on inside; tarsi black with basal white rings on all segments except the ultimate ones of the front legs; rings concrete and fairly broad except on ultimate segments. Length: body 4 to 4.5 mm.

Male. Vestiture as in female. Genitalia: side pieces about three times as long as wide; apical lobe fairly prominent; basal lobe small, rounded, delicately rugose and somewhat sparsely but uniformly setose; claspettes fairly long and curved; minutely setose at base; the filament of the claspette curved, delicate, and fairly long; an angular lateral expansion at the middle of the filament.

Holotype: One female, labelled No. 13042a; Yale, B. C.; 8. VIII. 20.

Allotype: One male, labelled No. 13042b; Yale, B. C.; 19. VII. 20.

The above are No. 521 in the Canadian National Collection.

There are also twelve Paratypes, distributed in the Collections of Dr. H. G. Dyar and the author and in the National Collection at Ottawa.

The writer is much indebted to Dr. H. G. Dyar, as it is through his assistance and kindness that he has the privilege of naming the above species.

NOTES ON THE ODONATA OF GODBOUT, QUEBEC

BY E. M. WALKER,
Toronto, Ont.

During the season of 1918 Mr. T. B. Kurata and the writer spent the greater part of July and a few days of August at the fishing village of Godbout, Province of Quebec, on the north shore of the lower St. Lawrence nearly opposite the town of Matane. The main object of our trip was to secure a series of casts of salmon in their various stages, and such other fish as were obtainable, for the Royal Ontario Museum, but plenty of time was available for collecting and observing other groups of animals and plant life.

Such success as we met with was largely due to the interest shown in all branches of our work and the kindly advice given us by the veteran hunter and naturalist, Mr. Napoleon Comeau, who was for 50 years the guardian of the Godbout River. His book, "Life and Sport on the North Shore," should be read

by all who are interested in our northern wilds. Without the benefit of his intimate knowledge of the country and its wild life it would have been difficult to find, without much loss of time, such varied territory for collecting as is described below.

The white cottages of Godbout village are scattered along a single road, which follows the curved shore line for about a mile eastward from the mouth of the Godbout River. The village is built upon a low, sandy plateau, rising abruptly from the gravelly beach to a height of ten or twelve feet, and extending inland for several miles of somewhat uneven jack pine barrens. To the west is the mouth of the Godbout River, one of the most famous salmon streams in America, while to the east is a range of high, wooded hills, extending from far inland to the shore, which they follow for many miles. Between the plateau and the hills is a richly wooded ravine, in which flows a small, clear, cold stream, whose waters are drawn from many lakes among the adjoining hills.

Godbout lies within the Canadian Life Zone, but is not far from the edge of the Hudsonian Zone, the change to a colder climate being rapid as the Gulf is entered, owing to the influence of the Labrador current. The vegetation is typical of the northern coniferous forest. The tree growth consists mainly of jack pine, black and white spruce, balsam fir, aspen and balsam poplar and white birch, a few other trees occurring more locally, such as white cedar, tamarack, gray birch, black ash and mountain ash. Among the smaller seed-plants bunchberry (*Cornus canadensis*) is almost everywhere. The undergrowth of the pine barrens is dominated by several species of the heath family, especially Labrador tea, sheep laurel, mountain cranberry (*Vaccinium vitis-idaea*) and various blueberries; while among the commonest plants in the rich ravines are, besides the bunchberry, the wild sarsaparilla, the wood-sorrel (*Oxalis acetosella*), the northern Clintonia, the creeping snowberry, and the goldthread. Club-mosses, mosses and lichens are also very abundant here. The mountain lakes usually have a fringe of alder, bog-myrtle, or in the more boggy places, leatherleaf, against a background of black spruce, while on the sandbars we found the beach pea, wonderful patches of blue flags, and the finest clumps of hairbells I have ever seen. Sphagnum is abundant everywhere, even on the pine barrens, while ordinary weeds of European origin are noticeably scarce, even in the open places about the village. Here the short grass is thickly sprinkled with a small, white, strawberry-like flower (*Potentilla tridentata*), which proved a great attraction to butterflies, particularly the little northern fritillary *Brenthis chariclea boisduvalii*, which was very abundant here and on the barrens.

The principal localities where dragonflies were collected were as follows:

(1). Several lakes on top of the range of hills. The nearest of these, which will be called lake 1, is about a quarter of a mile long, surrounded by a dense spruce forest, the water dark and peat-stained and nearly free from the larger aquatic plants. It had very little open marsh anywhere along its shore. The second lake (lake 2), not more than about 100 yards distant from the first and connected with it by a little brook, is smaller, shallower, with clearer water. It has a wide belt of open bog along one side and at the upper end, and a considerable quantity of both standing and floating aquatic vegetation. Lake 3, also near lake 1, has clear, colourless water and a gravelly bottom. It is the smallest

of the lakes. Lake 4 is much larger than all the others put together, being apparently about seven miles long. The shore is partly rocky, but we explored very little of it.

(2). A small lake (lake 5) about two miles north of the village, behind the pine barrens. This is the headwaters of the creek which opens at the east end of the village. The shore is rocky at the near end where the creek flows from it, but at the opposite end and for a considerable distance along both sides there is a wide, open marsh. A small creek flows into the lake at the upper end, through the marsh.

(3). The creek which flows from lake 5 to the east end of the village. Its course is for the most part through dense woods, but there are a few open places near the village, and a few bare sand bars. Numerous rapids occur along its course.

(4). The outlet of lake 2, a small brook connecting lakes 1 and 2. It has a gentle current and flows partly through woods, partly through an open bog. It widens slightly at the mouth, where the current becomes imperceptible.

(5). The Godbout River, a wild, rushing stream of cold, clear water. It is a typical salmon river and is not suited to dragonfly life, except along the edges of the quieter pools, where it is inhabited by two or three species.

(6). A few small ponds and puddles on the Godbout River flats below the last fall. The river here is influenced by the tides and these pools are connected at high tide, so that the water is frequently renewed. The pools are inhabited by the nymphs of certain species of *Somatochlora*.

(7). A small, stagnant puddle at the edge of a cultivated field. It was polluted with fish-manure, but contained nymphs of *Sympetrum decisum*.

The Dragonfly Fauna.

Dragonflies were sparsely represented, as were apparently most groups of insects. The small number of species taken is due partly to the cool, northern climate, partly to the absence of certain types of environment, and partly to the shortness of our visit. The season is very late in this region, and we left on the fifth of August, so that some of the later species had not yet appeared on the wing. For instance, although we found nymphs of *Aeshna umbrosa*, we saw no adults, and of *Boyeria grafiana* we obtained only one adult, which was reared, though nymphs were common; while only a few tenerals of *Sympetrum decisum* had begun to appear when we left.

Species not taken by us, which are regional and probably occur somewhere in the vicinity of Godbout, are the following:—*Agrion aequabile* (Say), *Coenagrion resolutum* (Hagen), *Enallagma cyathigerum* (Charp), *Aeshna sitchensis* Hagen, *A. juncea* L., *A. subarctica* E. Walk., *Gomphus brevis* Hagen, *Somatochlora franklini* (Selys), *Sympetrum scoticum* Don. and probably other species of *Ophiogomphus*, *Somatochlora* and *Sympetrum*. The absence of *C. resolutum* is rather surprising, as this is one of the commonest and most generally distributed of all the northern Zygoptera. The lack of any species of *Lestes* is also noteworthy, but it is possible that they emerged after we left. *L. disjunctus* Selys. is the species that is commonest in the north.

1. *Agrion maculatum* Beauv. Common along the creek joining lakes 1 and 2, July 16—Aug 1. Frequently observed also on the trail through the woods.

near the outlet of lake 1. Also seen on the creek at the outlet of lake 5 on July 21.

2. *Coenagrion interrogatum* (Selys). Found only about the marshy border of lake 2, where it was not uncommon, July 16, 24. It seemed to have disappeared on Aug. 1, when we made our last visit to this spot. A pair in copula were taken on July 24. It tends to fly over the water near the boggy shore, where reed beds occur.

3. *Enallagma calverti* Morse. Common in marshy places on all the lakes. First seen on July 12, a few on the trail near lake 1 and many on the shore of this lake, including mature specimens, tenerals and individuals just emerging. On July 24 it was much scarcer at lakes 1 and 2, but was still the prevalent dragonfly at lake 4, where many pairs were seen. By August 1 it had become quite scarce.

4. *Enallagma ebrium* (Hagen). The first specimen observed was a somewhat teneral female, taken on July 19 at lake 2. On the 24th it appeared in very large numbers at lake 1 and was abundant also at lakes 2 and 3, nearly replacing *calverti*. On Aug. 1 it was already much scarcer.

5. *Ophiogomphus colubrinus* Selys. A female, somewhat teneral, was captured on July 8 in the open pine barrens, close to the ravine in which the creek flows. Following this capture we watched for some time at the creek but got only one fleeting glimpse of a green gomphine, probably this species, flying swiftly down stream.

Numerous exuvia of Ophiogomphus, apparently representing two species, were found on the banks of the Godbout River on July 26 and 31. They were found on the moss under overhanging foliage and had evidently been near the waterline when the insects emerged, though they were a few feet away from it when found.

6. *Gomphus exilis* Selys. This species was not seen until July 24, when it appeared at lakes 1 and 2 in fair numbers. They flew over the bushes at the water's edge, resting on branches and on the ground in sunny places along the portage between the two lakes. On July 28, while collecting at the creek, a small gomphine resembling this species was seen to settle now and then on a gravelly part of the shore, but it was so wary and flew so swiftly that we failed to capture it.

7. *Cordulegaster maculatus* Selys. Very common, flying along the course of the small brook, connecting lakes 1 and 2, and also frequently seen patrolling the creek. The first specimen was taken on July 13 at the edge of a patch of woods a few rods from the creek. When patrolling the stream they fly very close to the water, except when they rise to clear logs or other obstructions.

8. *Cordulegaster diastatops* (Selys.). This species occurred with the preceding at the brook between lakes 1 and 1, but was not seen elsewhere. It flew up and down stream in the same manner as that species, or was sometimes seen alternately hovering over the water or moving onwards in a jerky fashion. Occasionally it was observed in open places nearby, where it would sometimes rest upon a bush or branch. It was common on July 16 and 24, while only a single specimen was taken on August 1. All the specimens taken were males.

9. *Boyeria grafiana* Wmsn. Two full-grown nymphs of this species were brought to us from the Godbout River on July 13, one of them transforming to an adult on the 26th. On the latter date we found several nymphs at the edge of the river, some of them under stones at the water line. All were apparently ready to transform, though one had died. No adults were seen at large at any time.

10. *Aeshna eremita* Scudd. This large dragonfly was first noticed on July 19 at lake 2 and was in full colour at that time. Several were seen coursing over the lake or patrolling its margins irregularly. It was frequently seen thereafter but was soon outnumbered by *A. interrupta*. On the 25th both species appeared in numbers around a waterfall near Point des Monts, about seven miles east of Godbout. On the following day we found them in large numbers flying over the Godbout River flats. They were hawking after a species of Crambid moth which was exceedingly abundant in the grass. Swarms of Aeshnas were observed here also on the 29th and 31st of July, but of a large number captured only a few individuals taken on the 29th were *eremita*. Exuvia were frequently found on the marshy borders of lake 2 and on the open bog on lake 5. While collecting at the latter locality on August 3 a male of this species was hawking over the swamp and was evidently attracted by the blackflies that were circling around my head. This habit is common with Aeshnas and some other dragonflies.

11. *Aeshna interrupta* E. Walk. Not seen until July 21, when a young female was taken at the outlet of lake 5. After this date it speedily became abundant, soon outnumbering *A. eremita*. It was common near Point des Monts on July 25, associated with *eremita* (q. v.), and appeared in large numbers on the Godbout River flats on the 26th, 29th and 30th. While watching for Somatochloras at the pools on the flats *A. interrupta* would occasionally visit the pools but never for more than a few minutes. They did not appear to breed here, in fact we did not find their exuvia anywhere. Like the preceding, this species was sometimes attracted by the blackflies around us. On Aug. 4 Aeshnas were flying not only over the flats but also farther up the river, where the valley is narrow and heavily wooded. Many were even flying over the rapids.

12. *Aeshna umbrosa* E. Walk. One or two young nymphs of this species were found in the creek, but no adults appeared. Its season for transformation perhaps had not begun when we left, though in Ontario the first individuals regularly appear before those of *Boyeria grafiana*.

13. *Cordulia shurtleffi* Scudd. Very common at all the lakes, although few females were seen at any time. Its season was in full swing when we made our first trip to lake 1 on July 12. Males were skirting the edge of the lake in some numbers. They flew within reach of the net from shore and about a foot or less above the water. They were still fairly common on Aug. 1, when we made our last trip to the mountain lakes, but none were noticed at lake 5 on Aug. 3, though they had been abundant here, to judge by the number of exuvia present. One was observed with *Somatochlora albicincta* at one of the ponds on the Godbout River flats. Its movements were similar to those of this species, except that it kept within a few inches of the water. Exuvia were very common on the marshy borders of lakes 2 and 5.

14. *Somatochlora minor* (Calvert). First observed on July 16 at the brook connecting lakes 1 and 2. The first specimen taken was a male, which was flying in one of the more open spots in the sunlight. Afterwards many other males were seen flying over the stream, sometimes following the course, sometimes hovering over the water at the height of one or two feet, or flying in small openings nearby, patrolling the space in the usual way, 4 to 8 feet from the ground. It was not found at the outlet, being distinctly a species of the small, quietly running streams. It was also taken on subsequent visits to this locality and on Aug. 1 a male was captured at the creek which flows through the open bog at the opposite end of lake 2. All the specimens seen were males.

15. *Somatochlora albicincta* (Burm.). The first specimen was taken on the morning of July 16. It was a male and was hovering over the quiet water at the mouth of the brook between lakes 1 and 2, and moving up stream a few yards and then back again to the mouth, keeping within a foot or so of the water. Another appeared at the opposite end of the creek, where the current is likewise imperceptible, and a third was taken on July 18 while skirting the boggy edge of lake 2, near the outlet. Near the upper end of the same lake are several small, clear, sluggish streams and on each of these one or two specimens of *S. albicincta* were flying on Aug. 1. About a dozen specimens were also captured while flying back and forth over the small ponds and puddles on the Godbout River flats, which were filled but not wholly flooded at each tide. Most of these were taken on July 29 and were all males except one female, which was ovipisiting. These insects seemed to prefer one of the largest ponds, which was about 20 feet long and 10 feet wide and almost free from vegetation except a few small reeds, but not more than two or three individuals appeared there at a time. The males moved along rather slowly with rapidly vibrating wings, but when two came in contact or approached one another, they would often dash off together with great speed, leaving the pond for a few minutes, after which one of them would return, apparently having succeeded in driving the other away. As a rule they keep about a foot above the water or marsh. When flying around the pond they would often also follow the small outlet for a short distance and sometimes they would fly back and forth over a small wet marsh, with numerous puddles, near the pond, examining the latter also on their way. The female was seen but a few seconds, tapping the water with the end of her abdomen and moving along as she did so.

Two nymphs were taken from the small puddles along with several of *S. forcipata*, on July 29, and from one of these a perfect male emerged at Toronto on June 1 of the following year. An exuvium was found on the shore of lake 5 on Aug. 3.

16. *Somatochlora cingulata* (Selys). First observed on July 16, this large species was frequently seen and taken throughout our visit to this region. In contrast to the other species of the genus it frequents lakes rather than streams or ponds, and often roams a considerable distance afield. The first specimens seen were flying at a height of 10 to 20 feet about the lower end and the outlet of lake 2 and in openings in the woods nearby. They seldom came within reach of the net and only two specimens, male and female, were taken. They seemed

sensitive to light and disappeared as soon as the sky became overcast. On July 19 there was but a brief period of sunshine, and only one or two *cingulata* were seen in this locality, both flying at a height of 40 to 50 feet and soon disappearing. On the 21st we visited lake 5, the headwaters of the creek, and here we found *cingulata* in numbers. This lake is almost surrounded by bog, but in the vicinity of the outlet the shore is rocky for a short distance, and the stream bed, as it leaves the lake, is also rocky. It was about the outlet and the adjacent rocky shore that *cingulata* was chiefly found, and it was only here that we saw the female ovipositing and found the exuvia. Males were flying here and there over the water, following a rather irregular course, sometimes following the shore a little way, but sometimes deviating and flying out over the water. The flight resembled that of *Macromia* or *Epicordulia* and was not jerky like that of *S. minor* or *C. shurtleffi,* i. e., there was no hovering over one spot. It was usually quite low, within two or three feet of the water, but sometimes they would dash upwards, particularly when two came together. They were not easy to capture, but by remaining in certain favourable spots we finally managed to net 17 specimens, all males. Several attempts at copulation were witnessed, but the pair usually dropped into the water and separated. Several times females were seen ovipositing after the manner of *S. albicincta.* This always took place near the outlet, where there was some current, but not actually in the stream. Careful search among the bushes along the shore near the outlet revealed a number of exuvia, together with a much larger number of *C. shurtleffi.* They were a few feet from the water's edge, but this had evidently receded considerably since the insects had emerged. In a few cases the exuvia of *S. cingulata* were hung up on bushes but the majority were lying upon the ground. On this occasion the sun was overcast much of the time, though there were many periods of bright sunshine, but the dragonflies showed little tendency to discontinue their flight and were almost continuously active.

On subsequent occasions this species was frequently taken, often flying about the edges of the woods or over the open barrens at a considerable distance from its breeding places. It was seen on all the lakes and was one of the dominant species on lake 4, the largest of the series. A female was also taken on the shore of the St. Lawrence, near Point des Monts, on July 5.

17. *Somatochlora kennedyi* E. Walk. This species was seen only on July 29, when it appeared with *S. albicincta,* flying over the two larger ponds on the Godbout flats. Two females were seen, one of which was captured after several failures; and a female was taken by Mr. Kurata while ovipositing in one of the ponds.

18. *Somatochlora forcipata* Scudd. Mr. Kurata discovered the dark-coloured nymphs of this species in the small puddles in the Godbout River flats. Several were found on the 26th, and another, together with an exuvium, on the 29th. The nymphs, which were all full-grown, were kept alive and fed during our stay at Godbout, but only three were carried through the winter. One of these died in the spring, while from the others two females emerged on May 29, 1919.

This was apparently the commonest nymph in these puddles, and yet no adults were seen here, the only species of the genus observed flying over the

puddles being *S. albicincta,* of which two nymphs were found, and *S. kennedyi,* the nymph of which is still unknown.

19. *Libellula quadrimaculata* L. On July 21 this species was flying in some abundance over the large marsh at the head of lake 5. A small creek flows through the marsh into the lake, and it was chiefly about this creek and over the adjoining lake margin that the Libellulae were flying. They were also seen here on Aug. 3, but the weather being cool and windy, they were all at rest among the rushes until flushed, when they flew with almost their usual speed. A single individual was also seen on July 24 at lake 2.

20. *Libellula exusta julia* (Uhler). Apparently rare or local in this locality, as only one specimen was taken. This was a female and was captured on July 16 at the mouth of the creek connecting lakes 1 and 2.

21. *Sympetrum decisum* (Hagen). A full-grown nymph of this species was found on July 11 in a ditch on the edge of a somewhat marshy clearing near the village. The water was very dark and was polluted with fish-manure. A few teneral adults were also taken near the village on July 25.

This species is one of the forms commonly known as *S. rubicundulum,* but, in the writer's opinion, is distinct from the form most commonly quoted under this name in the eastern United States, while it is undoubtedly conspecific with the western form *decisum,* as recognized by Ris (Cat. Coll. Selys, XIII, 684, 1911).

22. *Leucorrhinia hudsonica* (Selys). First observed on July 16 at lake 2. It was common on the open bog all around the lake, both tenerals and fully mature individuals being present. The majority were mature males, while all the tenerals examined were females. A few copulating pairs were seen. This species was also taken here on July 19 and 24 and on Aug. 1, but had become scarce on the last date. They were also taken in small numbers at lake 5 on July 21 and Aug. 3. A female was observed on July 24 ovipositing close to a boggy part of the shore of lake 1. Exuvia were found at lake 2 on July 19 and at lake 5 on July 21.

23. *Leucorrhinia proxima* Calvert. The most abundant *Leucorrhinia* ot Godbout. It was found with the preceding species wherever the latter was observed and, except on July 16, it was always the commoner species. On this date it was first seen on the large bog at the head of lake 2, where it was common. It was in full colour and two copulating pairs were taken. On the 19th it was abundant everywhere on this lake, though few of either this species or *hudsonica* were visible so long as the sun was overcast. When the weather cleared, however, they seemed to appear in an instant. Like *hudsonica* they became scarcer about the beginning of August. On Aug. 3 a few were flying about lake 5, but the weather was cool and windy and they were very sluggish. In addition to the localities mentioned *L. proxima* was not uncommon on July 29 and 30 about the small puddles on the Godbout River flats, where the Somatochloras occurred. Exuvia were found at both lakes 2 and 5, where the adults were most common.

24. *Leucorrhinia glacialis* Hagen. Rare at Godbout, only three males having been taken. One of these was captured on July 20 in an open wood near the pine barrens, the nearest lake (lake 5) being a mile away. The other two were taken at lake 2 on July 24 and lake 1 on Aug. 1.

ON THE SYNONYMY OF THE PEA MOTH

BY CARL HEINRICH,
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In the Canadian Entomologist for November 1920 (pp. 257—258) I stated that our American pea moth, which had been known for many years as *Laspeyresia nigricana* Stephens was different from the European species of that name and proposed for it the name *novimundi*. In this I was in error and I regret exceedingly that I was led into making an entirely unnecessary synonym for a well known economic species. The American and European pea moths are identical and the name *novimundi* Heinrich must fall as a synonym of *nigricana* Stephens. I find upon revising the Laspeyresiinae that our series of European specimens of *nigricana* in the National Museum are mixed and represent two distinct but very close species: *nebritana* Treitschke and *nigricana* Stephens (*nebritana* Zeller, not Treitschke) both under the name *nebritana* Treitschke. Unfortunately the specimen I selected for genital study and the harpe of which I figured (fig. 25 p. 258, Can. Ent., 1920) was one of the true *nebritana*. Genitalia of other males from the series agree with those I figured for *novimundi*. The two species (*nebritana* Treitschke and *nigricana* Stephens) have been kept separate in European lists but have been more or less confused. In fact Spuler intimates that they may be synonymous. Both are pea moths. Their genitalia however show them to be quite distinct.

The figures given in my previous article (and which by the way are printed upside down) represent: fig. 24, *Laspeyresia nigricana* Stephens (*novimundi* Heinrich) and fig. 25, *L. nebritana* Treitschke (*nigricana* Heinrich, not Stephens.)

NOTES ON THE COLEOPTERA OF SOUTHERN FLORIDA WITH DESCRIPTIONS OF NEW SPECIES

BY W. S. BLATCHLEY,
Indianapolis, Ind.

My last season's collecting in Florida began on November 18th, 1921, the day after I reached my winter home at Dunedin, and continued until April 14th, 1922, the day before I started on my spring migration northward. There was, however, an interim between December 20th and February 15th, when but little collecting was done, as the coleoptera were then mainly dormant and hibernating beneath the most available cover.

On March 19th I started on a twelve days' collecting trip to the Lake Okeechobee region, making my headquarters at first at Moore Haven, a town of about fifteen hundred population located on the former southwestern shore of the lake, but now twelve miles inland and connected with it by a dredged canal along the former outlet and source of the Caloosahatchie River. The region for miles around Moore Haven is a flat muck prairie, the former bed of the lake, almost devoid of shrubs and trees, so that no beating could be done. By sweeping herbage and using a water net in the canal and some tributary ditches, I succeeded in securing a good number of species, mostly aquatic or semiaquatic in habit. On March 23, I left with a friend on a small freight boat which he was running between Moore Haven and various points around the southern half of the lake. We were gone four days, living on the boat, and I was able to collect, sometimes several hours at a time, while he was discharging and taking on freight.

When I first saw Lake Okeechobee in 1911, and again in 1913, its shores were practically uninhabited and almost unmarred by man. Land about the lake could then be bought for $5.00 or less per acre. Close to the water it was covered with shrubs and vines growing so densely that there was scarcely a place where I could use a sweep-net to advantage.[1] Now there are four towns of three hundred to one thousand inhabitants each, around this portion of the lake, and the shores, where not too marshy, are one almost continuous settlement. Little if any of the land can now be purchased for less than $300 per acre. The vegetation has been so cleared away that only at two stopping points was I able to do any beating, but had to collect by sweeping in truck patches and along roadsides, or by searching beneath debris along the lake beaches. For that reason I got few species that I had not taken before, but quite a number which were desirable as additions or duplicates.

Returning to Moore Haven on the evening of March 26th, I left the next morning for Palmdale, a station near Fish-eating Creek, where I was able to do some fairly remunerative beating for a half day; then taking the evening train north some forty miles, I stopped at Istokpoga, a station only, near the west shore of the large lake of that name. I had been here for several days in the spring of 1913, and found conditions but little changed. A partially drained cypress swamp with numerous shrubs growing about its margins and some near-by meadows furnished both excellent beating and sweeping grounds, and I had here the most successful and pleasant two days' collecting of the trip. At Lake Wales, in one of the most beautiful citrus-growing regions of South Florida, I was able to stop a day, but rain prevented work in the afternoon, coming on just after I had taken my first and only specimen of the new *Leptotrachelus* described below. Leaving there by flivver at 3 p.m., a drive of ninety or more miles to the northwest, via Lakeland and Tampa, put me in to Dunedin at about 8 o'clock in the evening of March 31st.

In the pages which follow I have included notes on the distribution or habits of a number of Floridian species sent me by other collectors or taken by me in previous years, in order that our knowledge of the beetle fauna of the State may gradually be made more definite as to local distribution. Many of the older Coleopterists, including both Leconte and Horn, were content to put "Fla." or "Florida" after their descriptions, forgetting that the State is approximately 400 miles long, 360 miles wide across its northern border, and contains an area of nearly 60,000 square miles. Representatives of three distinct faunas, the Austroriparian, Subtropical and Tropical, live within its bounds, and the time has come when more definite and accurate distribution notes, than those furnished by the mere name of the State, are in demand.

Cicindela dorsalis saulcyi[2] Guer.—This handsome form, which has the elytra wholly white, was found April 11th, in small numbers, on the Gulf beach at the south end of Hog Island opposite Dunedin. I had not before taken it in the State, though Leng records it from several localities along the west coast, and states[3]

1—See Can. Ent. XLVI, 1914, 62.

2—In the notes and descriptions which follow, the nomenclature and sequence is that of Leng's Catalogue of the Coleoptera of America North of Mexico. The Rhynchophora taken will be treated elsewhere.

3—Bull. Amer. Mus. Nat. Hist, XXIV, 1915, 561.

that: "It appears to be confined to the shore of the Gulf of Mexico, extending westward to Texas."

Dyschirius filiformis Lec.—One specimen of this slender bodied little Carabid was taken February 26th from beneath a board on the margin of a brackish water pond. Its length is but 2.7 mm., though stated in the original description to be .14 inch (3.5 mm.). Recorded by Schwarz as rare at Ft. Capron and Haulover on the east coast, and by Leng from Punta Gorda.

Clivina dissimilis sp. nov.

Elongate, convex, relatively robust. Head, thorax and under surface dark chestnut-brown; elytra reddish-brown, shining, with a broad vague angulate fuscous shading at base and another at middle; antennae dark brown; fore femora chestnut-brown, the legs otherwise reddish-brown. Head impunctate, front with a short, distinct median groove, each side of which is a minute carina; clypeus entire, rounded at sides. Thorax strongly pedunculate, its disk subquadrate, slightly longer than wide, smooth, the median impressed line entire; hind angles rounded, not dentate; lateral marginal line not reaching the base but bent inward and forming a pseudo-basal margin midway between the true base and the plane of the upper surface. Elytra conjointly a little narrower than thorax, disk striate and punctate on basal half, both striae and punctures becoming faint or obsolete towards apex, third stria with two dorsal punctures. Middle tibiae without subapical spur. Intermediate anal setae-bearing punctures approximate. Length 4.7 mm.

Described from a single example taken at Dunedin, December 1st, from beneath a board in the damp sand of the bay beach. Evidently a submaritime species belonging to the *bipustulata* group of Fall.[4] Resembles superficially in color and size *rubricunda* Lec., but easily distinguished by the longer thorax, with unarmed hind angles and pseudo-basal margin.

Leptotrachelus depressus sp. nov.

Elongate, slender, depressed. Pale dull yellow throughout except the elytra, on which there is a narrow sutural piceous stripe beginning about basal fourth and of nearly equal width to apical fourth whence it gradually widens to apex. Head smaller and less convex than in *dorsalis*, behind the eyes distinctly shorter with sides more rounded than there. Antennae with joints 5—11 pale brown, all except the basal one pubescent. Thorax subfusiform, widest at middle, the sides very broadly curved, feebly sinuate near base; disk with a fine median impressed line, smooth except in a vague curved impression each side of basal third, where there are a few shallow punctures; margins with a single median bristle-bearing puncture. Elytra elongate-oval, strongly depressed, very feebly striate, the striae with fine, very slightly impressed punctures, these obsolete near tip; intervals flat, the second with two setae-bearing punctures. Length 6 mm.

Lake Wales, Fla., March 31st; a single male taken from between the leaves and stems of a tall saw-grass growing in shallow water along the margin of a lake. Others might have been found but a heavy shower prevented. Very different from *dorsalis* in color, shape of head and thorax, and in the strongly depressed feebly striate elytra. The disk of elytra, viewed from above, appears to be feebly concave in the common area between the fifth stria of each side

4—Ent. News, XXXIII, 1922, 164.

Thalpius pygmaeus Dej.—One specimen was taken from beneath debris near the water of Lake Okeechobee at both Pahoka and Canal Point and a third at Moore Haven. From the State it has been heretofore recorded only from single specimens taken at Ft. Capron and Enterprise.

Anatrichis minuta (Dej.)—This species, usually regarded as scarce, was taken in numbers from beneath debris at all points visited on Lake Okeechobee, and also along the canal at Moore Haven. It occurs just above high water line in dry, sandy spots. Next to *Oodes duodecimstriatus* Chev. it was the most common Carabid found about the lake.

Stenolophus conjunctus (Say).—This widely distributed little Carabid appears to vary much in hue. Several specimens having the upper surface wholly shining black, but not apparently otherwise differing from the common form, were taken in April from beneath debris on the bay beach at Dunedin.

Agonoderus pallipes (Fabr.)—Two specimens of this common northern form were taken at Moore Haven from beneath shore-line debris. Not before known from Florida, though its near relative, *A infuscatus* Dej., is common in the State.

Omophron labiatum (Fabr.)—This, the only member of the genus known from Florida, is distributed throughout the State. I mention it here only to record its abundance along the canal at Moore Haven, where it was found by scores buried in the narrow margin of damp sand along the edge of the water. By scraping aside with a trowel a half inch or more of the sand over a small area, the backs of a half a dozen or so of the beetles would be exposed. If not too much disturbed by the scraping they would remain quiescent, but when touched would hurry away to the nearest shelter or attempt to burrow deeply into the protecting sand.

Pachydrus princeps (Blatch.).—The third known specimen was taken February 22nd from amongst some decaying water weeds in the edge of Jerry Lake, three miles east of Dunedin. The type was from Lake Okeechobee near Pahoka and the second specimen from Ft. Myers.

Matus bicarinatus (Say).—A single specimen was taken from beneath beach debris at Pahoka. It is the third I have from the State, where it appears to be very scarce.

Cercyon variegatum Sharp.—This small Hydrophilid was taken in numbers at Palmdale and Istokopoga, March 28—30, from beneath cow dung in low, moist woods. Others are at hand from Dunedin, taken from beneath the same substance in February and March.

Cercyon testaceum sp. nov.

Oblong-oval, subconvex. Color in great part reddish-brown, shining; the elytra each with an area beginning on margin at basal third and widening gradually and obliquely backward to meet and cover apical fourth, pale brownish-yellow; antennae reddish-brown, the club piceous. Head broader between the eyes than long, finely and closely punctate. Thorax twice as broad as long, sides broadly curved from base to apex, the margin reaching hind angle only, disk finely, evenly and densely punctate. Elytra finely striate, the striae minutely and closely punctate; intervals slightly convex, the eighth and tenth very narrow and unseriately punctate, the others wider, minutely closely punctate. Under sur-

face and legs smooth, concolorous, the meso- and mestaternal areas finely and sparsely punctate, the former narrowly elliptical, the latter subhexagonal, without lateral prolongations. Length 2.5—2.8 mm.

Sarasota, Ft. Myers and Pahoka, Fla., February 14—March 25. One specimen taken at each place from decaying vegetation on the edges of fresh water ponds or lakes. The Sarasota specimen and type is the one formerly recorded by me[5] as *C. variegatum* Sharp, but the taking since of two additional examples and of numerous specimens of *variegatum* show the latter to be shorter and more broadly oval, distinctly more convex, more sparsely punctate and with head and thorax wholly or in part piceous. The colors of the elytra in *testaceum* are in arrangement and extent like those of the common *C. praetextatum* (Say), the reddish-brown corresponding to the black and the paler yellow to the yellow of that form. In *praetextatum*, however, the eighth and tenth intervals are not narrowed and have two or more rows of punctures. This is the only wholly pale species of *Cercyon* known from the eastern United States, and belongs under the No. 11 of Horn's key.[6]

Ptinidium ulkei Matth.—A form which agrees in all essential characters with the description of this minute species occurs frequently beneath cover on the bay beach at Dunedin throughout the winter. Schwarz records[7] a *Ptenidium atomaroides* Mots. as "Common in salt marsh on the eastern coast" of Florida. Leng, in his Catalogue, includes this with a question mark. From some source I have a note that the species so listed by Schwarz is *ulkei*, which was described from the District of Columbia.

Xestipyge (*Paromalus*) *conjunctum* (Say).—A specimen of this small Histerid was taken at Dunedin, February 26th, from a pile of decaying unhulled rice, and another, March 14th, from beneath the skeleton of a horse. Definitely known from the State only from Fernandina.

Saprinus sphaeroides Lec.—A specimen of this very shining bronzed species was taken at Dunedin from beneath cover along the bay front in February, and others are at hand from Little River. They are smaller than those taken in Indiana along the beach of Lake Michigan, but show no structural differences. Recorded from Florida only from Enterprise.

Hydnocera pallipennis Say.—A single specimen was taken at Dunedin, April 8th, while sweeping ferns in Skinner's Hammock. Not before recorded from Florida, though known from Canada to Alabama.

Isohydnocera (*Hydnocera*) *aegra* (Newn.)—A rather common species about Dunedin, where it occurs in winter and spring on the tall dead grasses about the margins of ponds. Taken also at Lake Wales.

Tetraonyx quadrimaculata (Fab.)—One specimen taken at Gainesville and sent me by Prof. Watson. Known hitherto in the State only from Crescent City, where Schwarz (Ms.) found it "rare and feeding on *Centrosema virginianum* Benth., a wild large flowering pea."

Nemognatha punctulata Lec.—Also taken at Gainesville by Prof. Watson The types of Leconte were from Georgia and it has not since been recorded from elsewhere.

5—Bull. Amer. Mus. Nat. Hist., XLI, 1919, 322.
6—Trans. Amer. Ent. Soc., XVII, 1890, 290.
7—Proc. Amer. Phil. Soc., XVII, 1878, 439.

Mecynotarsus elegans Lec.—This handsome little Anthicid was not known from the west coast until discovered by Mr. Fall, who took a half dozen or so, April 3rd, on the bay beach just south of my residence at Dunedin. After his departure I found them quite plentiful beneath weeds and boards on the dry sand above high water mark. When uncovered they remain quiet for some time, and being so small, with hues blending perfectly with that of the sand, they are invisible. It is only by lying flat on the sand and watching for motion that they can be seen. Once started they run very rapidly towards the nearest cover. Schwarz records it as "common on the ocean beach (of the east coast) in May and June."

Anthicus (*Acanthinus*) *trifasciatus* Fabr.—Several specimens of this coarsely sculptured West Indian species were obtained about Dunedin during the winter. They were taken while beating a pile of the dead leaves of cabbage palmetto, and from beneath cover along the bay front. Known from the State heretofore only from Cape Sable and Key West.

Sericus silaceus (Say).—A single individual was swept, March 27th, from the foliage of the moonvine near Moore Haven. Known heretofore in the State only from St. Augustine and Haulover on the east coast.

Agrilus lateralis (Say).—While beating bunches of Spanish moss in a partially drained cypress swamp at Istokpoga I secured about a dozen examples of this large and handsome Agrilid. The only record for the State is that of Frost[8] from St. Augustine, April 21st, 1919. Its known range extends from Maine to New Mexico.

Brachys aeruginosa Gory.—My first Floridian specimen of this little Buprestid was also obtained with the *Agrilus* above mentioned. It has been taken in the State only at Jacksonville.

Ora troberti (Guer.)—Two examples of this prettily colored species were recently received from Chokoloskee. It is a Mexican form, recorded from Texas and taken by Schwarz (Ms.) at Crescent City, Fla., though his specimens may be the *O. texana* Champ. which Horn erroneously referred[9] to *troberti*. *O. texana* occurs sparingly about Dunedin on marsh golden-rod and at porch light.

Scirtes orbiculatus (Fabr.)—I can find no record of this well marked form from Florida. Specimens are at hand from Dunedin, Lakeland, Istokpoga and Palmdale. It occurs on foliage in the close vicinity of water.

Cryptorhopalum ruficorne Lec.—This species is at hand from Ormond, Gainesville, Dunedin, Lake Wales and Palmdale, Fla. Schwarz recorded it as rare at New Smyrna and Enterprise. It is taken in spring by sweeping huckleberry and other low shrubs.

Cryptorhopalum picicorne Lec.—This is a frequent Dermestid in Florida, having been taken by me at seven different stations, but it does not appear in any of the lists nor in the Leng Catalogue from there. It occurs throughout the winter either beneath cover or on the flowers of various plants.

Tenebroides corticalis (Melsh.)—Evidently a scarce species in Florida, as it is recorded only from Lake Worth[10] by Hamilton. My first and only speci-

8—Can. Ent. 1920. 249.
9—Trans. Amer. Ent. Soc., VII,I 102.
10—Can. Ent., XXVI, 1894, 252.

men from the State was taken at Dunedin, March 14th, by beating a bunch of Spanish moss.

Tomarus pulchellus Lec.—A common northern form hitherto known in Florida only from St. Augustine. A specimen was taken at Moore Haven, March 29th, and another at Dunedin, April 8; the former by sweeping, the latter beneath weeds on the sand of the bay front. Its congener, *T. hirtellus* Sz., is frequent beneath dead leaves at Dunedin throughout the winter.

Synchita dentata Horn.—The unique type, described from Tampa, Fla., appears to be the only specimen so far recorded.[11] A single individual was taken March 14th at Everglade while beating. It differs from *S. granulata,* which is frequent in Florida, in being smaller, darker, with head and thorax much more coarsely granulate. My specimen has the sides of thorax 10-dentate, not 8-dentate as stated by Horn.

Eufallia seminiveus (Mots.)—This minute and prettily marked Lathridid, formerly known as *Belonia unicostata* (Bel.), was taken in numbers in February and April from beneath an empty fertilizer sack lying in a barnyard near Dunedin. It is known from Cuba and Mexico, and has been recorded from Crescent City, Fla., by Fall.[12] They crawl very slowly when exposed to the light, and being only 1.3 mm. in length, are almost invisible. The color is rufo-testaceous, the head and thorax, in fresh specimens, covered with a white, wax-like secretion, whence the specific name.

Scymnus oculatus Blatch.—The second known specimen of this minute Coccinellid was taken March 24th while beating custard apple etc., near the lock of the Hillsboro Canal a mile east of Lake Okeechobee. It differs from the type only in having the common pale central spot of elytra much larger, covering the greater part of the disk but surrounded on all sides by a black margin. The unique type[13] was from Dunedin.

Leichenum variegatum Kust.—The first Florida specimen of this handsome little Tenebriod was discovered April 4th by Fall on the bay beach at Dunedin, and I afterward found three additional examples. They occurred with *Mecynotarsus elegans* beneath creeping weeds on the dry sand above high water mark, and remained motionless when uncovered. It was described from Madagascar and has been taken in this country only at Mobile, Alabama, by Loding.

Cis lodingi Dury.—A single example is at hand from Ormond, Fla., April 15th. Dury's types were from Mobile, Alabama, and it has not been recorded elsewhere.

Cis impressa Casey.—One male was taken at porch light at Dunedin, June 10 and identified for me by Dury. The first record for the State.

Orthocis pulcher Kraus.—Two specimens were obtained at Lakeland, February 16th, by beating dead branches of oak. Described[14] from Key West and not hitherto known elsewhere.

Euphoria limbalis Fall.[15]—This is the species listed by Schwarz[16] as *E. fulgida* var. It was taken by him at Enterprise, Biscayne Bay and Buck Key.

11—Trans. Amer. Ent. Soc., XII, 1885, 139.
12—Trans. Amer. Ent. Soc., XXVI, 1899, 143.
13—Can. Ent., XLIX, 1917, 140.
14—Proc. Ent. Soc. Wash., X, 1908, 78.
15—Can. Ent., XXXVII, 1905, 273.
16—Proc. Amer. Phil. Soc., XVII, 1878, 451.

I recently received a specimen from Chokoloskee. It probably replaces *fulgida* throughout the State.

Cryptocephalus albicans Hald.—Schæffer (Ms.) regards this as a valid species, and reports a specimen in his collection from Gulfport, Fla. I have recently received one for naming from W. T. Davis, taken May 5th at Lakeland. Neither *albicans* nor *gibbicollis* Hald., of which Leng places *albicans* a synonym, have been hitherto recorded definitely from Florida.

(to be continued.)

A NEW GENUS AND SPECIES OF XYELIDAE (TENTHREDINOIDEA, HYMENOPTERA) FROM WESTERN CANADA.*

BY C. HOWARD CURRAN,
Ottawa, Canada.

Neoxyela new genus

Possesses all the characteristics of *Xyela* Dalman, but there are only two marginal cells (free part of R2 wanting) and the ovipositor is almost as long as the head, thorax and abdomen combined, and is curved downwards. Genotype *N. alberta*.

Neoxyela alberta new species

♀. Length 3 mm.; ovipositor 2.75 mm. Antennal furrows obsolete above, front broadly depressed on the middle line between the antennal furrows; anterior ocellus sunken, the posterior ones bordered behind with deep depressions which extend interiorly to join the depression around the anterior one; a faint depression extending from the outside of the lateral ocelli to the vertex. Front finely scrobiculate, the swollen vertical area finely transversely rugose; the depressions and sides more polished. A well marked transverse depression between the antennæ; between which and the clypeal suture it is gently swollen; labrum short, broad, evenly rounded; clypeus carinate in the middle, its apex gently rounded; only a little broadly prominent in the middle. Face whitish yellowish, the supra-clypeal carina and the sutures piceous blackish; front piceous blackish, a moderately broad occipital stripe, curving towards the vertex above, whitish yellow. Antennae piceous, the third segment not quite as long as the following segments combined; the fourth slightly longer than the fifth, the apical segment a little swollen.

Thorax piceous black, the tegulæ, postcalar calli and pectus whitish yellow. Scutellum not with a median longitudinal depression.

Legs with the coxae and femora piceous black, the bases of the femora, apices of the coxae and the remainder of the legs piceous yellowish.

Wings dilutely yellowish, the stigma over twice as long as broad, second marginal cell nearly three times as long as the first.

Abdomen piceous, the venter with a yellowish tinge, ovipositor curved downwards, its basal four-fifths piceous yellowish, the apex black.

Holotype. ♀, Banff, Alberta, May 27, 1922, (C. B. D. Garrett); No. 520. in the Canadian National Collection, Ottawa.

Paratype. ♀, Banff, Alberta, June 5, 1922, (Garrett).

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*—Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.

NOTES AND DESCRIPTIONS OF SOME FOSSORIAL HYMENOPTERA

BY NATHAN BANKS,
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Below are a few descriptions and notes on Philanthidae and Scoliidae.

Philanthus consimilis n. n.

P. assimilis Bks., Can. Ent. 1919, 404 (not Bull. Amer. Mus. Nat. Hist. XXXII, 422, 1913.)

Cerceris salome n. sp.

♀. Black, marked with yellow; spot on base of mandibles, above base of mandibles, each side on face, above and below clypeal process, median carina, flagellum below, dot behind eyes, small spots on pronotum, postscutellum, two spots on first abdominal segment, broad band, emarginate in middle, on the second, narrow marginal bands on other segments above, broader on last, yellow. Legs yellow, tarsi darker, and femora black except hind femora at tips, hind tibiae with inner apical dark spot. Body rather evenly and coarsely punctate. Clypeal process about twice as broad as long, margin slightly concave; enclosure strongly longitudinally striate; stigma blackish; pygidium twice as long as broad, sides parallel. Length 13 mm. From Long Island, and Nyack, N. Y.; Wellesley, Mass. (Morse); and Jones' Creek, Lee Co., Va.

In my table (1912) it runs to 25, where it will not agree with either alternative; differing in the yellow marks, the band on second segment broader than others, the clypeal process concave in front, and the enclosure striate. It resembles *C. halone* in general, but the enclosure is different, and the clypeal process longer.

Cerceris sayi n. sp.

♀. Black, marked with pale yellow as follows: Base of mandibles, double spot on the clypeal process, long spot each side on face, spot behind eyes, two on pronotum, the postscutellum, two large spots on propodeum, two large spots on the first abdominal segment, and subequal broad bands on each of the following segments, broadly emarginate in front; venter black, unmarked; legs reddish to yellow in part; antennae reddish on basal part; wings rather smoky, darker towards the costal tip, stigma reddish; moderately coarsely and densely punctate, clothed with white hair, that on head, pronotum, propodeum and basal abdominal segment very long; tawny hair on each side of the pygidial area, and a tuft each side at tip. Clypeal process large, suberect, one and a half times as broad as long, hardly narrowed at tip, deeply, angularly emarginate in front. Enclosure evenly, rather coarsely, and almost longitudinally striate. Basal abdominal segment much broader than long; pygidial area two and one half times as long as broad, sides nearly parallel, and fully as broad at base as elsewhere, finely punctate. Length 14 mm.

♂. More slender; marked as in female but face mostly yellow and spots on the propodeum smaller; clypeus truncate below, surface nearly flat; hair-combs about twice their length apart; enclosure striate on sides, smooth in middle, pygidial area broader near tip than at base, coarsely punctate; femora of front and mid pairs with black spot, hind femora largely black at tip, and also apical half of the hind tibia black. From Steele, N. Dakota, July 13 (Stevens).

Cerceris stevensi n. sp.

In general similar to *C. sayi* in marks, hair, punctuation, etc., having in addition a white spot above the base of mandibles, one on pleura below tegula, a broad band on the scutellum, spots on the propodeum very large, and the abdominal bands rather broader at lateral ends. The clypeal process is proportionally broader, but of the same general shape; the pygidial area is much broader at base than elsewhere. Length 16 mm. From Steele, N. Dakota., July 13 (Stevens).

Trielis alcione Bks.

A pair from Sheldon, N. Dakota, Aug. 10, (Stevens).

The male agrees with the type of *T. alcione*; the female, hitherto unknown, is black, marked with red and yellow; the vertex, base of mandibles, and basal joint of antennae are rufous; two spots on pronotum, three on the scutellum, line on postscutellum, large median spot on the propodeum as well as lateral marks, and four pairs of spots on the abdomen, all slenderly connected; venter wholly black; legs largely rufous; hair on venter white, that on dorsum largely tawny, hair on head and thorax mostly white. Length 22 mm.

My table of the females (Bull. Mus. Comp. Zool. LXI, 112) may be changed as follows to include *alcione*.

3. A median yellow spot on propodeum; transverse frontal suture straight; the anterior ocellus not twice its diameter from the suture; spots of abdomen connected 4

   No median spot on propodeum; transverse frontal suture sinuate; anterior ocellus fully twice its diameter from the suture; spots of abdomen separated 5

4. Thorax and abdomen largely black; venter unspotted ..... *alcione*

   Thorax and abdomen largely rufous; venter with a pair of spots on third segment ..... *regina*

5. Insect mostly rufous; fore wings with a dark streak near the tip; hair on abdomen above and below golden ..... *xantiana*

   Insect largely black, the streak of fore wing reaching nearer to base; hair on dorsum of abdomen much darker than that below ..... *octomaculata* (*lupina*).

NEW APPOINTMENTS TO THE ENTOMOLOGICAL BRANCH

Mr. E. R. Buckell was appointed Assistant Entomologist on November 27th, 1922. He is attached to the Division of Field Crop and Garden Insects. Mr. Buckell received his B. A. from Cambridge (Eng.) in 1911. Subsequent to the war he was engaged by the British Columbia Department of Agriculture on insects affecting the range.

Mr. C. R. Twinn was appointed Junior Entomologist on September 14th, and is attached to the Division of Field Crop and Garden Insects. Mr. Twinn received his B. S. A. from O. A. C. in 1922, and was engaged in a temporary capacity on the European Corn Borer work at Port Stanley during the past summer.

Mr. R. H. Painter has recently been appointed Junior Entomologist and attached to the above Division. Mr. Paintner graduated from O.A.C.in 1922. During the summers of 1921 and 1922 he was engaged on the European Corn Borer work.

Mr. R. Glendenning received his permanent appointment as Junior Entomologist on September 14th, 1922. He has been employed at the Agassiz, B. C. laboratory since April, 1921. Mr. Glendenning has received special training in horticulture at the Experimental Gardens of the Royal Horticultural Society in England and has engaged in nursery work in Canada. He is particularly well fitted to investigate fruit insects, at which work he is now engaged.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1922.

The Annual Meeting of the Entomological Society of Ontario for the year 1921—22 was held at the Ontario Agricultural College, Guelph, on Friday and Saturday, November 24th and 25th.

The general meetings of the society were held in the lecture room of the Department of Entomology. On Friday evening a dinner was held in the College cafeteria, after which the members and visitors adjourned to the Common Room of Mills Hall for a smoker and social evening, when the President, Mr. Morris, read an interesting paper on a collecting trip to Rondeau Park and Point Pelee.

The meetings were well attended by members of the Society and by visitors from the Ontario Agricultural College and others.

The following program was presented:—

Moving picture film, "The European Corn Borer,"—Ontario Provincial Motion Picture Bureau.

"The Spread of the Corn Borer in 1922,"(10 minutes)—L. S. McLaine, Dominion Entomological Branch, Ottawa.

"Further Notes on the Life History of the European Corn Borer," (10 minutes)—G. J. Spencer, Ontario Agricultural College, Guelph.

"Revised Control Measures for European Corn Borer," (15 minutes)—H. G. Crawford, Dominion Entomological Branch, Port Stanley.

Discussion on European Corn Borer.

"The Economic Importance of Insects as Food for our Common Whitefish,"—Dr. W. A. Clemens, University of Toronto, Toronto.

"The Haunts and Habits of Somatochlora," (15 minutes)—Dr. E. M. Walker, University of Toronto, Toronto.

"Mechanical Devices used in Control of the Strawberry Root Weevil," (15 minutes)—W. Downes, Dominion Entomological Branch, Victoria.

"Provancher, His Life and Works," (10 minutes)—George Maheux, Department of Agriculture, Quebec.

"Observations on the Oviposition of *Senotainia trilineata* V. der Wulp. (Tachinidae)," (5 minutes)—C. H. Curran, Dominion Entomological Branch, Ottawa.

"Insects of the Season in Quebec," (10 minutes)—George Maheux, Department of Agriculture, Quebec.

"The Relationship of Biological and Taxonomic Studies of Syrphidæ (Diptera)," (10 minutes)—C. H. Curran, Dominion Entomological Branch, Ottawa.

"Insects of the Season in Ontario," (10 minutes)—Prof. L. Cæsar, Ontario Agricultural College, Guelph, and W. A. Ross, Dominion Entomological Branch, Vineland Station.

"Notes on *Frankliniella tritici* Fitch,"—R. C. Treherne, Dominion Entomological Branch, Ottawa.

"Biologic Notes on two Buprestid Beetles (*Agrilus ruficollis* and *A. politus*)," (10 minutes, lantern)—C. B. Hutchings, Dominion Entomological Branch, Ottawa.

"The Outbreak of Grape Leaf-Hoppers," (15 minutes)—W. A. Ross and W. Robinson, Dominion Entomological Branch, Vineland Station.

"The Feather Mite,—a New Poultry Pest," (10 minutes)—Prof. L. Cæsar, Ontario Agricultural College, Guelph.

"Some Observations on the Oviposition of *Hypera punctata*," (5 minutes)—H. F. Hudson, Dominion Entomological Branch, Strathroy.

"Recent Developments in the Dominion Entomological Service," (20 minutes, lantern)—Arthur Gibson, Dominion Entomological Branch, Ottawa.

"The Sunflower Maggot," (10 minutes)—J. E. Brink, Ontario Agricultural College, Guelph.

"Recent Work on the Rose Chafer," (15 minutes)—W. A. Ross, and J. A. Hall, Dominion Entomological Branch, Vineland Station.

"The Occurrence of the Potato Seed Maggot, *Hylemyia trichodactyla* in Ontario," (5 minutes)—G. H. Hammond, Dominion Entomological Branch, Ottawa.

The officers of the society were re-elected save that Mr. J. A. Flock was elected curator in place of Mr. Spencer.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF AMERICA

The seventeenth annual meeting of the Entomological Society of America was held in Boston, Massachusetts, in the buildings of the Massachusetts Institute of Technology, on December 26th, 27th, and 30th, 1922. The meetings were unusually well attended, the attendance ranging from about seventy-five to two hundred and fifty in the different sessions.

Seventy-four new members were elected during the past year, bringing the total membership to 652, the largest in the history of the Society.

The following officers were elected:

President: Prof. T. D. A. Cockerell, University of Colorado, Boulder, Col.

First Vice-Pres.: Dr. Wm. S. Marshall, University of Wisconsin, Madison, Wis.

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POPULAR AND PRACTICAL ENTOMOLOGY

ERORA LAETA EDW. (LEPID.)

BY HENRY MOUSLEY,
Hatley, Que.

It is hardly necessary for me to make any apology for calling attention to such a butterfly as *Erora laeta*, a rarity in all collections, and perhaps the only one found hereabouts, which, as the describer observed in 1869, seems to be tropical in its colouring and quite out of its latitude in the Northern States and Canada. I am greatly indebted to Mr. Albert F. Winn of Montreal, who in a letter dated October 19, 1920, first drew my attention to the insect. In this letter, whilst speaking of the Hairstreaks, he says "Niphon is always associated with young white pines, but *laeta*, a beautiful blue and black species, just simply happens to get caught by someone with a net. Its food plant and life history are absolutely unknown, not the slightest clue existing, so get busy and find out something for us at the same time as you are hunting for orchids and birds."

As will be noticed, this was in October, 1920, and all through the long winter months I had imaginary visions of capturing *laeta* in the following spring, not that I actually had any real hopes of doing so, certainly not of setting up the earliest record (the previous one was May 18) for the capture of the insect in these parts.

However, this was so, as on April 30 I captured a male in a small wood about one quarter of a mile from my house. As will no doubt be remembered, the spring of 1921 was a very early and hot one, the thermometer on the day in question registering 74 degrees at noon. This no doubt was responsible for the unusually early emergence of the insect, thus more than justifying its vernacular name of "The Early Hairstreak." The place of capture was on some rising ground covered with a thick mantle of dead beech leaves on the outskirts of a small wood. As might be supposed, at such an early date I had no net with me, and the insect was taken between my finger and thumb as it crawled over the dead leaves, having apparently not long emerged. Thinking the matter over later on, and looking to the fact that the only trees in the immediate neighborhood of the capture were a cluster of beech and small hemlocks, I came to the conclusion that probably the former would eventually turn out to be the food plant. The larvæ, after having fed up, would no doubt attach themselves to the underside of the leaves and with them drift to the ground in the fall, remaining buried alive under a mantle of snow all winter to emerge the following spring, when the weather conditions became favourable. How many times I visited that little wood during the next few weeks, I am not going to say, but it was all in vain, for I never saw another *laeta*.

However, on May 21, in company with two friends, Mr. Napier Smith, of Magog and Colonel Morrill, of Dufferin Heights, I climbed Mt. Orford in search of a particular fern which it was hoped would be found near the summit, 2,860 feet above sea level. When about half way up, the trail became very ob-

scure, owing to lumbering operations, and as the other two had never climbed the mountain before, they decided to rest a little whilst I endeavoured to get my bearings. It was during this reconnaissance that I came upon a female *lacta* hovering round a beech tree, the lower branches of which could be easily reached by standing on the slopes of a little gully in which the tree stood. Brother Entomologists, imagine my feelings when I tell you that again I had no net (the impedimenta of a bird, orchid, fern and butterfly enthusiast is truly appalling and cannot always be carried, especially on a long climb) and my two friends, who might have been able to render some assistance, were now out of sight. In cases like this a rapid decision has to be arrived at, and I think I made the right one, that of carefully watching instead of trying to capture and perhaps injuring the insect, for I felt sure she was depositing ova. I had not long to wait, for she almost immediately settled on a leaf and deposited an egg This leaf I secured, and watched her to another, but I realized that it was going to be an almost impossible thing to keep my eye on the exact leaf and on her further movements as well, so I called to my friends to come help. They wondered what all the excitement was about, and took their time in responding to my frantic appeal, thinking I had found the eggs of some bird or other, which, of course, could very well wait their time. When they did arrive, I had lost sight of *lacta* whilst gathering the second leaf she had flown to, but upon which she had unfortunately failed to deposit. We remained round the tree for some time, but to no purpose, for *lacta* never appeared again. However, I had the satisfaction of being the first person to witness *lacta* deposit an egg in the open and amidst her natural surroundings, and of afterwards seeing the resulting larva, besides discovering the food plant, a thing hitherto unknown. Of course, it is just possible there may be other food plants as well.

Both my friends admitted it was the smallest egg they had ever seen. It was situated on the underside of the beech leaf close against the mid-rib and nearly at the base of the leaf. The exact time of laying was 1.15 p.m. The colour was pale green of a bluish tinge, the surface being perfectly smooth to the naked eye, although under the microscope according to Scudder there are raised hoary points about .02 mm in height and .03 mm apart. The micropyle is .1 mm. in diameter, the height of the egg .32 mm. and the diameter .72 mm., according to the same authority. The first apparent change took place at 7 a.m. on the 25th, the inside of the egg becoming transparent with a small, dark substance (the larva) forming through the centre. On the 27th this dark substance was becoming smaller and less distinct. On the 28th at 7 a.m. another decided change had taken place, all the dark substance had entirely disappeared, the whole of the egg appearing a pale straw colour. At 6.30 p.m. on this same day there was no further change, but at 11.30 p.m., when I again examined it, I found the young larva had hatched.

It was covered with small hairs and was about 1 mm. in length, as near as I could judge, the colour being pale straw. Assuming the emergence to have taken place at 9.15 p.m., the egg stage had lasted exactly seven and one third days. On the 29th at 10 a.m., the young larva had fed in five or six places on the leaf during the night, and was doing well, the head being a deeper colour to the rest of the body, being brown. On the following and succeeding days to

June 3 everything was progressing satisfactorily, and I had every hope of rearing this larva, as I was familiar with many of the Thecla family, having reared all the five British species, including the rarest *Thecla pruni*. Fate, however, was against me, in the shape of an invitation to spend the night of June 3 away from home. This I accepted, leaving the little larva apparently quite well with a good supply of fresh food plant. On arrival home the following evening, I was grieved to find the latter nearly black, and the former (which was then from 1.75 to 2 mm. long) quite dead. What happened can only be surmised. The sun's rays (it was a very hot day) probably finding their way through an opening in the trees surrounding the house, and shining directly onto a pane of glass in the window, thus killing the food plant, and the young larva as well, as they were on the window sill. Thus ended my first experience with *Erora laeta*, but I hope it may not be the last. At all events, now that I have made known the food plant, it should not be so difficult for other collectors to fill up the gaps in its life history.

The male was originally described by W. H. Edwards in the Proc. Academy of Nat. Sciences, Philadelphia, 1862, p. 55, from two examples taken near London, Canada West (Ontario) by Mr. Saunders in 1861.

The female was described by the same author the following year in Proc. Entom. Society of Philadelphia, Vol. II, p. 15 (1863), from a specimen taken by Rev. Mr. Provancher near Quebec City, but he did not recognize it as being the same insect of the opposite sex and therefore gave it a new name, *Thecla clothilde*.

Both sexes are beautifully illustrated by figures of upper and under surfaces in Edwards' "Butterflies of North America," Vol I, pl. 47 (plate 1 of Thecla) and described on page 147. The localities cited are Canada, Maine and West Virginia. A note is given on the author's lucky capture of a specimen near his residence at Coalburgh, W. Virginia, in 1868. In Scudder's splendid work on the "Butterflies of the Eastern U. S. and Canada," appropriate verses or lines of poetry are placed at the head of each article, and under *Erora laeta* we read:

"How would, I say, mine eyes be blessed made
By looking on thee in the living day."—Shakespeare Sonnet.

He refers to it as an exceedingly rare butterfly in the East, having been taken on very few occasions, and then only single specimens have been obtained at any one time, though these captures show it to be widely distributed, including St. Joachim, 25 miles from Quebec (Bowles); London, Ontario (Saunders); Catskill Mts., N. Y. (Edwards); Atlantic City, N. J. (Aaron); Coalburgh, W. Va. (Edwards). It remained the rarest of our Hair-streaks till 1883, when Edwards, Papilio III, 8, reported the receipt of a collection of butterflies from Mt. Graham, Arizona, in which, to his surprise and delight, were no less than thirty examples, the geographical range of the species being thus extended over a thousand miles from the home of its nearest known relatives. In New England two localities in Maine are cited, near Paris (Smith) and Orono (Fernald). Scudder then relates the capture by himself on June 30th of a female near Williamstown, Mass., as follows:

"Walking along thinking of the butterflies whose early stages were un-

known, my thoughts turned to the present species, recalling thereby the lines I had already placed in this work, I repeated them aloud almost unconsciously. I not gone half a dozen steps before I came to a damp spot in the road, when *laeta* alighted at my very feet. Although it was the first time I had seen the charming object alive, I instantly recognized it, and in another second my net was over it, and I shouted triumphantly,

"How have, I say, mine eyes been blessed made
By looking on thee in the living day."

It is thus that we have found and made our acquaintance with *laeta*. None of us have ever gone out with the express intention of looking for it. As related in "The Canadian Entomologist," Vol. XXIII, 1891, p. 96, Mr. A. F. Winn spent May 24, 1888 at St. Hilaire, Que., and after climbing to the bald rock on the top of Beloeil Mountain (1,500 ft.) he had only gone a few yards down the path when a butterfly flew past, settled, and was easily caught, a female *laeta*. On several subsequent visits to St. Hilaire, on or about Victoria Day, May 24th, Mr. Winn informs me a solitary example has been stumbled upon by one or other of our members, always, he thinks, along paths through the woods. Respecting other localities in Canada, the late Rev. Dr. Fyles (An. Rept. Entom. Soc. of Ont., 1896, p. 12) mentions a specimen taken at Sherbrooke, Que., by the Rev. Abbé Bégin on May 25, 1895. Mr. C. H. Young records the capture of two specimens at Meech Lake, Que., on May 18 (An. Rept. Ent. Soc. Ont. 1903, p. 91), also two on June 14 and 15, 1907 (An. Rept. Ent. Soc. Ont., 1907, p. 119). An example from Digby, N. S., is reported by Mr. Russell (An. Rept. Ent. Soc. Ont., 1906, p. 92) taken June 7. On May 18, 1921, Miss Muir captured a female at 16 Island Lake, Argenteuil Co., Que., in the Laurentian Mts., and the following day, her friend, Miss Metayer, took another female. Both these examples were fluttering along a path through the woods close to the water's edge, and settling on beech twigs. One of these has kindly been presented to the collection of McGill University in the Lyman Entomological Room. On May 24, 1922, Mr. Winn, with six of our members (The Montreal Branch of the Entomological Society of Ontario) was again at St. Hilaire, when an example of *laeta* was seen but unfortunately not captured. I myself saw nothing of it during the season, although I kept a sharp lookout for it in the little wood near my house, and also on Mt. Orford, which I again visited for ferns on June 26, but this, of course, was too late to hope for much as regards *laeta*.

The dates of capture in this province and in Ontario would indicate a single brood in a season, wintering apparently in the chrysalis stage; but Scudder's capture in Massachusetts above quoted on June 30; Aaron's at Atlantic City July 1; and Smith's at Norway, Me., on July 22, seem to prove that a second brood is found to the south of us.

Scudder sacrificed his specimen in the hope of securing eggs by caging her over wild cherry, but although the abdomen was full of eggs, she lived many days without laying. He gives, however, a drawing executed by Blake, of an egg from a Maine specimen, but by whom or how the same was secured is not stated. In conclusion, I again wish to thank Mr. Winn, not only for having drawn my attention to *laeta*, but also for the notes concerning the localities and dates of the capture of this rare little butterfly.

NOTES ON THE COLEOPTERA OF SOUTHERN FLORIDA WITH DESCRIPTIONS OF NEW SPECIES

BY W. S. BLATCHLEY,
Indianapolis, Ind.

(continued from page 20)

Cryptocephalus trivittatus Oliv.—An individual of this little dull colored species was sent me by Prof. J. R. Watson. It was taken at Bradentown, August 12, by sweeping grass and herbs in a vacant lot. Not before recorded from Florida. Superficially it resembles *C. incertus* Oliv., to which it is closely related, but differs in the densely punctured thorax, that of *incertus* being almost smooth. I have but two specimens of *trivittatus* from Indiana. It occurs mainly in the middle and eastern States, but is nowhere common.

Bassareus detritus (Oliv.).—Three specimens taken March 29th by beating Spanish moss and foliage in a partly drained cypress swamp along the margin of Lake Istokpoga. I can find no definite previous record of its occurrence in the State.

Leng in his Catalogue has, in my opinion, wrongly made *Cryptocephalus binominis* Newn. a synonym of this species. Newman's species is frequent in Florida, and is a true *Cryptocephalus*, the flanks of the front margin of the thorax being entire and the male not having a strong erect spine on prosternum as in *detritus*. In addition to these generic characters, the two are very different as follows.

Antennae very slender, in male as long as body, thorax subopaque, strongly narrowed in front; black area at base of elytra extending the full width and covering humeri; striae of elytra deeply impressed, the sixth and seventh interrupted, their punctures confused; intervals distinctly convex. ..... *detritus.*

Antennae less slender, half the length of body; thorax shining, but slightly narrowed in front; black area at base of elytra limited to the central portion, the humeri broadly red; striae of elytra not impressed, the punctures coarse, distant, all the rows entire; intervals flat ..... *binominis.*

The *C. notatus* Feb. of Haldeman[17] is the same as *B. detritus*, while his *distinctus* is a synonym of *C. binominis*. The *C. quadrimaculatus* Say, which Leng has placed as a variety of the true *C. notatus*, is quite similar in size and appearance to *binominis* but has the base of the elytra red, the striae slightly impressed, their punctures more numerous and much more closely placed.

Rhabdopterus blatchleyi Bowditch.—This species has been recently described[18] from examples taken by me at Dunedin. As stated by its author, they differ from the northern *R. piceipes* (Oliv.) mainly in being larger, stouter and more oblong, in the antennal joints 7, 10 and 11 being dark, and in the males having the apical half of hind tibiae compressed and rather strongly dilated. It is a rather common form in southern Florida, having been taken at nearly all the stations where collecting has been done by sweeping low herbage in early spring.

Leconte[19] arbitrarily, without seeing Olivier's type, made Say's *Colaspis praetexta* a synonym of *C. piceipes* Oliv. In this he was followed by Horn[20]

17—Journ. Phil. Acad., 1849, 255.
18—The Entomologist, LIV, 1921, 234. London.
19—Complete writings of Say, II, 211.
20—Trans. Amer. Ent. Soc., XIX, 1892, 227.

who states that his principal reason for so doing was that Lefevre in founding the genus *Rhabdopterus* had placed *piceipes* therein, "and as we have no representatives of the genus in our fauna other than *praetexta,* the conclusion must be that *piceipes* and *praetexta* are the same." The statement that there is but one species of *Rhabdopterus* in our fauna is a rather strange one for a man of Horn's ability to make, as new forms in almost all genera are continually being discovered. It of course is possible, but not probable, that as good an entomologist as Olivier would have given the name *piceipes* to an insect having as pale legs as does our northern form of the genus. On the whole it seems to me that it would be better to retain for our northern species the name *praetexta* Say until by comparison with Olivier's type it is shown to be the same as that species.

Paria canella opacicollis Lec.—Regardless of color it appears to me that this name should be retained for a form occurring in Indiana, Kansas and Florida, and probably in intervening territory. It is larger (3.3—4 mm.) than the variety usually known as *aterrima,* and always has the thorax subopaque, distinctly *alutaceous,* minutely and very sparsely punctate and the elytral striae finely and closely punctate. As once before stated by me[21], I have found that the presence or absence of an alutaceous surface is one of the most stable characters to be used in separating closely related species of Coleoptera. While *P. opacicollis* was described[22] from Kansas specimens, which were pale yellow in color and with black spots on elytra, it has been placed by most recent authorities (probably because the majority of the examples are black) as a synonym of var. *aterrima* Oliv. Among numerous specimens examined, I have found none with the thorax intermediate in sculpture between this and the other varieties of *P. canellus,* and the punctures of the striae are distinctly finer and closer set than in any. Specimens are at hand from Gainesville, Fla., and several stations in Indiana.

Calligrapha cephalanthi (Sz.).—This species has been taken at Ft. Myers by Davis. It is known only from Florida, where it occurs on the buttonbush, *Cephalanthus occidentalis* L., but has not before been noted south of Tampa. It is distinguished from its nearest ally, *C. similis* Rogers, by its more oblong form, very coarse punctures of femora and the lack of a median notch on the outer side of discal brown stripe of elytra.

Galerucella sexvittata (Lec.).—Numerous specimens were taken at Dunedin March 1st by sweeping foliage along the margin of a hammock and one at Lake Wales, March 31st; the first records for the State. Horn gives its range as Pennsylvania to Louisiana.

Phyllobrotica discoidea (Fabr.).—One female taken at Ocala April 14th. Not before recorded south of Georgia.

Oedionychis gibbitarsa (Say).—This common northern species had never been found by me in Florida until a half dozen or so were taken at Moore Haven, March 23, while sweeping low vegetation along the edge of a marsh. They have the elytra a deep cobalt blue in hue, not green as in the northern form. The head, thorax and femora are carmine red, not dull yellow as there, and the fuscous spots of thorax are five in number, not three or four as in the northern form, three of these forming a triangle at center and one on each side. A specimen

21—Journ. N. Y. Ent. Soc., 1921, 17.
22—Col. of Kans. & N. Mex., 1859, 23.

taken by Davis at Pablo Beach has the same combination of colors and the form probably represents a distinct southern race of *gibbitarsa*.

Oedionychis ulkei Horn.—This species occurs sparingly about Dunedin from February to April on the flowers of Ericads. Described from Florida without definite station record. Very close to *O miniata* (Fabr.) but averaging smaller, more oblong, with joints 3 and 4 of antennae subequal.

Oedionychis saltatra sp. nov.

Oval, subdepressed, shining, nowhere alutaceous. Dull yellow; elytra piceous, their tips and the narrow edge of side margins pale; antennae pale, joints 6—11 piceous, third and fourth equal, each twice the length of second. Hind femora often brownish-piceous. Head wholly pale, impunctate, a deep transverse impression between the eyes. Thorax more than twice as wide as long, margins feebly curved, rather broadly explanate, disk smooth. Elytra as wide at base as thorax, the sides thence broadly but evidently curved to apical fourth, then rounded to tips; side margins very narrowly explanate, the epipleura in great part vertical; disk minutely, sparsely and very shallowly punctate. Abdomen and femora finely and sparsely punctate, each puncture bearing a small, recurved bristly hair. Length 4—5 mm.

Dunedin and Sanford, Fla, February 20th—June 10th. Frequent about Dunedin in spring on low herbage in moist ground; taken at porch light in June. This species has the oval elytra of *limbalis* Melsh., but differs from the dark form of that species in having a nonalutaceous impunctate head and thorax and in the much finer and shallower punctures and the distinctly narrower and darker margins of elytra. By its elytral characters it would fall under the No. 2 of Series B of Horn's Key[23], but is different from any one of the three species there included. *O. limbalis* has not as yet been reported from Florida.

Oedionychis quercata obsidiana (Fabr.).—Two specimens of this form, having the thorax piceous with only the explanate side margins pale, were taken at Sanford March 31st. It is listed by Schwarz as *quercata* var. and is placed by Leng as a synonym of *quercata*. The typical northern form of the latter with thorax wholly pale has not been taken by me in Florida, nor can I find any definite record of its occurrence in the State.

Disonycha caroliniana (Fabr.).—This species was frequent at Palmdale, March 27th, on a tall shrubby St. Johns-wort. It has also been taken rarely at Dunedin, Lakeland and Lake Wales. About half of the specimens at hand have the thorax devoid of fuscous spots.

Haltica litigata Fall.—This is a common species in Florida, a part of Fall's types having been from Enterprise. I have taken it at the majority of my collecting stations and formerly confused it with both *ignita* Ill. and *amoena* Horn, probably neither of which occur in Florida. It is found in numbers in both Florida and Indiana on the water purslane, *Ludwigia palustris* Ell.; also beneath debris and decaying vegetation about the margins of extinct wet weather ponds and lakes, and at porch light.

Epitrix cucumeris Harr.—Strange to say this common northern little flea-beetle has not been reported from Florida, though its range is given as New England to Georgia and California. It was found in numbers, in company with

23—Trans. Amer. Ent. Soc. XVI, 1889, 190.

Chaetocnema quadricollis Sz. and *C. obesula* Lec., in gardens and low waste places, at Moore Haven and several of the stations around the south end of Lake Okeechobee, and the three, supposed by the natives to be one species, were said to do much damage to egg plant, cucumbers and other truck crops of that region.

Mantura floridana Crotch.—Occurs in March by hundreds on a species of *Rumex* along the bay beach at Dunedin; also occasionally on other low vegetation inland.

Chaetocnema floridana sp. nov.

Elongate-oval, strongly convex, relatively slender, tapering behind. Black with a brassy tinge; antennae with basal joints reddish-brown, fuscous beyond the middle; femora piceous-brown, bronzed, tibiae and tarsi reddish-brown. Head with occiput minutely alutaceous, rather coarsely, sparsely and deeply punctate; front between the antennae with a few coarse deep punctures. Thorax one-half wider than long, convex, sides declivent, their margins regularly curved, somewhat unevenly thickened; disk minutely alutaceous, rather finely and evenly, not densely punctate, its basal marginal line very fine, obsolete at middle. Elytra oval, not wider at base than thorax, distinctly tapering behind the middle; striae all regular, scarcely impressed, marked with coarse, well spaced punctures; intervals very narrow, slightly convex, not visibly alutaceous or punctate. Ventral segments of abdomen each with two or three irregular transverse rows of fine, deep punctures, the last one sparsely, irregularly, rather coarsely punctate. Length 2—2.2 mm.

Described from seven specimens taken at Dunedin and Lakeland, Fla., February 16th—April 24th. Taken by sweeping huckleberry and other low vegetation in open pine woodlands. This is the species recorded[24] by me as *C. cribrifrons* Lec. A recent careful study of all my species of the genus, supplemented by comparisons with Leconte's types for me by Mr. Fall, shows it to be very different from *cribrifrons* in its much smaller, narrower, more tapering form, less densely punctate thorax, narrower impunctate elytral intervals, more sparsely punctate last ventral of abdomen and other characters. The true *C. cribrifrons* has, therefore, not as yet been correctly recorded from Florida.

Chaetocnema minuta Melsh.—This little species is not mentioned in the Schwarz list or manuscript, but is recorded[25] by Horn as occurring in Florida without definite station. It occurs sparingly about Dunedin in March and April on the low vegetation of moist soils.

Chaetocnema alutacea Crotch.—One specimen taken at Dunedin, April 8th, by sweeping low herbage along the margins of a hammock. While Schwarz lists this as common on swampy meadows at several points along the east coast, it has not before been recorded from the western portion of the State, and his record may refer to *C. robusta,* described below. Horn gives its range as "northern Georgia to Florida."

Chaetocnema robusta sp. nov.

Oblong-oval, convex, very robust for the genus, but little narrowed before and behind. Black, subopaque with a faint, brassy tinge; antennae piceous-brown throughout; femora black, tibiae and tarsi dark reddish-brown. Head

24—Can. Ent., LI. 1919, 66
25—Trans. Amer. Ent. Soc., XVI, 1889, 263.

broad, minutely alutaceous, impunctate. Thorax subquadrate, one-third wider than long; sides broadly, regularly curved; disk alutaceous, finely, evenly, rather sparsely and deeply punctate. Elytra not wider at base than thorax, sides very slightly curved; humeri scarcely evident; umbones feeble, smooth; striæ all regular, rather deep, their punctures coarse, close-set; intervals minutely alutaceous, slightly convex, scarcely wider than the strial punctures, each with a single row of minute punctures. Abdomen very finely and remotely punctate. Length 2.7—3 mm.

Described from numerous specimens taken on Hog Island, opposite Dunedin, where it occurs in areas flooded at high tide, on the fleshy-leaved seaside plant, *Batis maritima* L. It has been in my collection and that of Mr. Fall for several years, under the name *C. alutacea* Cr., but on taking the specimen of that species above mentioned, I sent both it and specimens of *robusta* to Fall, who compared them with the type of *alutacea* in the Cambridge Museum, and found that what we had as *alutacea* was wrongly determined and probably an undescribed species. His specimens are in part from Mobile, Ala., and Tybee Island, Ga. It is easily distinguished from *alutacea* in form alone, being larger, more robust and oblong-oval, not elongate-oval, and strongly tapering behind as there. The uniform dark antennæ and reddish-brown tibiæ and tarsi are also excellent distinguishing characters.

Chaetocnema crenulata Crotch.—A single specimen of this short, broadly oval species, taken by Watson at Gainesville, is at hand. Recorded by Schwarz as rare in Sumter County and known only from Florida and North Carolina.

Chaetocnema quadricollis Sz.—Common in truck patches at various stations around the margins of Lake Okeechobee, where it is said to do much damage to different kinds of vegetables. It is not as yet known from the West Coast region. Horn in his description (loc. cit. p. 267) says that the head is impunctate, but it bears "a few scattered punctures," as stated by Schwarz.[26]"

In addition to the six species of *Chaetocnema* above mentioned, I have from Dunedin and other stations along or near the west coast, numerous specimens of *C. brunnescens* Horn, *C. pinguis* and *obesula* Lec. and *C. confinis* and *pulicaria* Crotch. Two additional species, not as yet taken by me, making thirteen in all, have been recorded from the State. These are *C. denticulata* (Ill.) and *C. parcepunctata* Cr.

As noted by me in a recent paper[27],the small Halticids belonging to the genus *Longitarsus* are much more numerous in this country than has been generally supposed. In an accompanying key to the paper cited, 19 were treated as occurring in the Eastern States, and other undescribed forms which were on hand were not there included. Three of these are from Florida and are herewith described.

Longitarsus tenuicornis sp. nov.

Elongate-oval, convex, winged. Dull reddish-yellow throughout, strongly shining. Head with front strongly compressed and subcarinate between the bases of the antennae, the sides just below the antennae with two or three coarse punctures; occiput smooth, not alutaceous. Antennae very slender, two-thirds the

26—Proc. Amer. Phil Soc., XVII, 1878, 368.
27—Journ. N. Y. Ent. Soc., XXIX, 1921, 18.

length of body, the terminal joint fusiform, pointed, in part dusky, joints 2, 3, 4 subequal in length, each one-third shorter than 5—11, which are also subequal. Thorax subelliptical, but slightly wider than long, side margins curved, thickened throughout, more so behind the front angles; disk minutely alutaceous, very finely and sparsely punctate. Elytra oval, about one-third wider at base than thorax, umbones evident, not prominent, sides very feebly curved, their tips conjointly rounded, not covering the pygidium; disk not at all alutaceous, relatively coarsely, closely and deeply punctate, the punctures separated by their own diameters Abdomen and hind femora minutely very sparsely punctate, each puncture bearing a fine appressed yellow hair. Length 1.7—1,9 mm.

Sanford, Dunedin, La Belle, Moore Haven and Ft. Myers, Fla., November 21st—April 4th. Common on low vegetation about the borders of ponds and lakes and at Dunedin on the fleshy crucifer, *Cakile edentula* (Bigel), along the bay front. In January I have on several occasions taken it by sifting along woodland paths. Next to *L. cotulus* it is the most common member of *Longitarsus* in southern Florida, and perhaps occurs in collections from that State under the name *testaceus* Melsh., which in the past has been a sort of catch-all for species wholly testaceous in hue. In my recent key to the eastern species above cited, it belongs under *h.*, with the exception that only the thorax is alutaceous. From both *cotulus* and *testaceus* it is easily separated by its nonalutaceous elytra and from *suspectus,* which it closely resembles, by the same character, and by the more slender antennae, joints 2—4 of which are subequal, by the exposed pygidium and other characters.

Longitarsus aeneola sp. nov.

Elongate-oval, subdepressed. Pale brown with a bronzed lustre, strongly shining; elytra each with a large, vague, ill-defined yellowish spot on and behind the humerus, and another at apex; antennae fuscous, joints 1—3 paler; under surface brown, the last two ventral segments paler; legs yellow. Head impunctate, the front but moderately compressed between the eyes. Antennae half the length of body, relatively stout, joints 2—4 subequal, 5—11 also subequal, each about one-third longer than 4. Thorax quadrangular, about one-third wider than long, sides curved, their margins thickened, uneven; disk finely, not closely, distinctly punctate, its sides but feebly declivent. Elytra elongate-oval, humeri rounded, umbones absent, sides very feebly curved, tips broadly separately rounded, not covering the pygidium; disk finely, closely, rather shallowly punctate; abdomen smooth. Length 1.8 mm.

Caxambus, Fla., March 6th; one specimen swept from low herbage near the margin of a salt water lagoon. In its subdepressed form, peculiar color of elytra, strong brassy tinge of upper surface and rounded tips of elytra it differs from all other described species. While the elytra are about one-fourth wider than thorax and the humeri evident, the umbones are absent and it appears to be wingless. It is probably a submaritime and subtropical form.

Longitarsus impuncticollis sp. nov.

Elongate-oval, strongly convex, wingless. Dark chocolate-brown, shining; antennae fuscous, joints 1—3 a little paler, 2—4 subequal; legs reddish-yellow. Head and thorax absolutely smooth, strongly shining, the latter subcylindrical, its sides strongly declivent, their margins evenly curved. Elytra at base not wider

than thorax, at middle one-third wider, humeri and umbones absent; sides feebly curved, tips narrowly rounded, not covering the pygidium; disk coarsely, densely and deeply punctate. Abdomen smooth. Hind tarsi longer and more slender than in allied species, the spur of hind tibiae also longer and more curved. Length 1.5 mm.

Dunedin, Fla., February 28th; swept from vegetation along the margin of a pond. Belongs under *nn.* of my key above cited, and allied to *solidaginus*, but easily separated by its longer, narrower, more attenuate form, smooth thorax, dark antennae and slender hind tarsi.

THE NAIAD OF PANTALA HYMENEA (ODONATA)

BY CLARENCE HAMILTON KENNEDY,
Ohio State University, Columbus, Ohio.

In March, 1920, the writer identified a series of Odonata naiads for the U. S. National Museum. Among these was a single Pantala naiad from Plano, Texas, which did not agree with the published descriptions of that of *Pantala flavescens*.[1] It was ascribed to *hymenea* (Say), as the only other species of that genus known.

While on a recent visit to Mr. Williamson at Bluffton the writer was given reared material of *hymenea*, several grown naiads and was given an auto ride to the place of their occurrence. This Bluffton material came from two concrete watering troughs on a farm east of Bluffton that was not far from a muddy seasonal slough. These troughs were about six feet long and two feet deep, containing at the time of our visit, about eighteen inches of algal filled water. Thirteen quarter-to-half-grown individuals of *hymenea* were raked out of one trough with an insect net. Many Corixas, of at least two species, Notonectas, two species, Mayflies and Chironomids, were obtained also, showing what a rich feeding ground the Pantalas enjoyed.

The interesting thing about the location was the fact that these troughs were cleared out and scrubbed at fairly regular intervals. So that counting back from the date of the emergence on Sept. 9, 1921 of Mr. Williamson's specimen, the trough had been cleaned twice, on July 15, 1921, when the specimens were brought in by the farmer and once previous to that, when all insects were thrown away. This previous cleaning had taken place, as well as the farmer could remember, at a date which was less than three months previous to Sept. 9, the date of the emergence. This gives a short life history to *hymenea*. With its marvelous powers of flight and ability to mature quickly in such shallow pools as are represented by a horse trough, we can get a glimpse of one of the reasons for the very wide spread of this species from Canada to the Argentine. Probably the same is true of its relative *flavescens* which is the only truly cosmopolitan dragonfly, for it is found throughout the tropics and even in such out of the way places as the Hawaiian Islands.

Probably other factors than the very short life history enter into the phenomenal success of these species, such as the very thin chitinous skeleton of

1—Needham, "Aquatic Ins. of Adirondacks" Bull. N. Y. State Mus. No. 47, p. 539, 1901.
2—From Needham's description "Aquatic Insects in the Adirondacks" Bull. 47, N. Y. State Mus. p. 539, 1901.

the naiad which must take little of the insect's growing power as compared to the very heavy shells of the primitive Odonata, also the truly wonderful flight of these species, for one cannot observe these on the wing without being impressed with their nonchalance and great ease on the wing, a sense of being undisturbed and completely at home in the air, come what may. This placid indifference while on the wing would make them victims of high flights and storms, and so might help account for their wide distribution.

The naiad differs from that of *Tramea lacerata* in that the lateral spines of segment 8 are barely as long as the mid-dorsal line of segment 9, while the mid-dorsal appendage is as long as the paired ventral appendages.

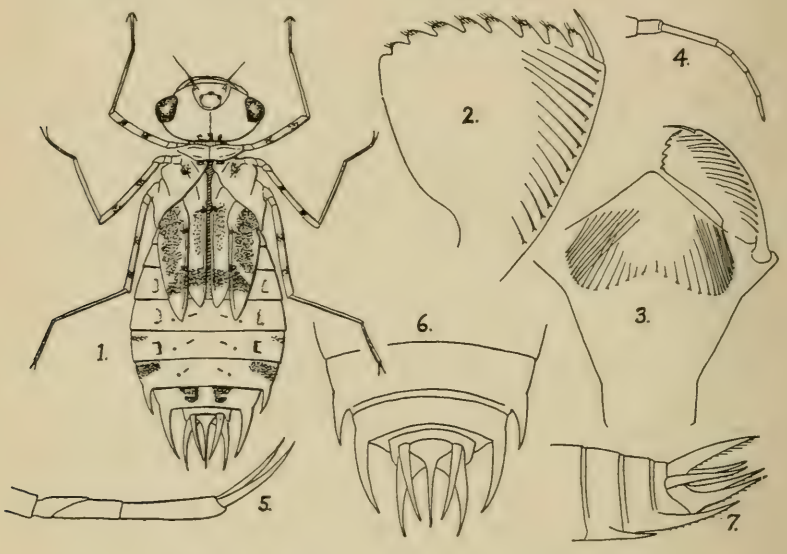

Fig. 1, Naiad of *Pantala hymenea* reared by E. B. Williamson, Figs. 2-7 details of same. 2. Lateral lobe of labium, 3. Labium. 4. Antenna. 5. Tarsus of hind leg. 6. Segments 8-10, dorsal view. 7. Segments 8-10, lateral view.

It differs from the naiad of *Pantala flavescens* in that the movable hook on the lateral lobe of the labium is twice as long as the crenulations of the distal edge of the lobe[2], while body measurements indicate that it is slenderer than the *flavescens* naiad.

The following is a description of the naiad of *Pantala hymenea*. Total length 28 mm.; abdomen 18 mm.; hind femur 7 mm.; width of abdomen 6.5 mm., of abdomen 10 mm.

Body clean, smooth and moderately depressed, six mm. high as compared to the width of 10 mm. A pair of conspicuous black spots on the dorsum of segment 9 and a second pair on the outer edges of segment 8. A less conspicuous pair, U-shaped, on segment 7, remote from its edges. A black spot at the base of each inferior appendage. Other pairs of minute spots on the abdomen as shown in fig. 1. Wing pads heavily mottled, the major part of which pattern is a broad band across their tips. Three less conspicuous spots on each side of the thorax. Legs with two bands on the femur while the tarsus is black. Three small, black spots on the occiput.

Head broad, two thirds as long as wide. Occipital "angles" rounded, occiput convex. Vertex prominent, surrounded by a distinct though shallow fossa. Antennæ, fig. 4, with the third segment longest, about twice the length of segment two, and three times the length of segment four. Labium with ten crenulations on its distal edge, those on the outer edges longer than wide, but towards the inner edge becoming flattened out so that the sixth to the tenth are broader than high. Movable hook twice as long as the highest crenulation. Lateral setæ 15, mental setæ 17—18, the outer ten set almost touching each other at their bases, the inner seven three times as far apart. Number 10 from the inner end the longest. See figs. 2 and 3.

Prothorax smooth. Legs slender. Minute, needle-like dorsal hooks on segments 3 and 4. Lateral spines, on segments 8 and 9 only, long and incurvate, those on segment 8 reaching the apical border of the ninth segment, those on segment 9 twice as long and reaching to the tips of the dorsal lateral appendages. Mid-dorsal and inferior paired appendages slightly longer than the combined lengths of segments 8—10, the dorsal-lateral appendages slightly shorter. All the appendages and lateral spines slender and needle-pointed.

OUR NORTH AMERICAN *LEUCOZONA*, A VARIETY OF *LUCORUM*. (SYRPHIDAE, DIPTERA)*

BY C. HOWARD CURRAN,

Ottawa, Ont.

Leucozona lucorum var. **americana** new var.

A comparison of seven specimens of *Leucozona* from North America and five specimens of *L. lucorum* L. from Denmark and England shows that the American specimens are either a very good variety of *lucorum* or a distinct species. I am inclined to believe the two distinct, but as the genus is so little known, place our form as a variety. The differences between the two are as follows:

L. lucorum americana: Third antennal joint a little shorter; facial tubercle longer, less prominent; pile of the mesonotum and scutellum wholly pale yellow; abdomen wholly black pilose beyond the second segment.

In the typical form the pile of the mesonotum is yellow on the disk and rather tawny on the lateral margins and scutellum; the abdomen is yellow pilose, except on the third segment and sometimes, in the male, a few black hairs on the disk of the fourth segment. The result is that the shining terminal segments appear metallic, while in the variety they are deep black.

Holotype— ♂, Hull, Quebec, June 6, 1903 (W. H. Harrington); No. 545, in the Canadian National Collection, Ottawa.

Allotype— ♀, Metlakatla, British Columbia, Rev. J. H. Keen.

Paratypes— ♂, Hull, Que., June 6, 1903, ♀ Smith's Cove, N. S., July, 1914, (Arthur Gibson); ♀ Chilcotin, B. C., June 29, 1920, (E. R. Buckell); ♀, no data.

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*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

NEW CANADIAN EPHEMERIDAE WITH NOTES*

BY J. MCDUNNOUGH,

Ottawa, Ont.

CAENINI.

Tricorythus atrata sp. nov.

Male. Head and thorax black, the latter shiny; abdomen dull blackish with traces of white intersegmental rings, somewhat paler ventrally. Fore legs blackish, paling towards the extremities, the tarsi being white-tinged; mid and hind legs with blackish femora and white tibiæ and tarsi; setæ white. Wings semi-hyaline with the usual dark mark along the costa. Length of body 2—3 mm.; of wing 4½ mm.

Holotype— ♂, Wakefield, Que., Aug. 6, (J. McDunnough); No. 546, in the Canadian National Collection, Ottawa.

Allotype— ♀, same data, in the Canadian National Collection, Ottawa.

Paratypes—16 ♂, 1 ♀, same data.

The species was common early in the day flying over the La Peche River, a small tributary of the Gatineau, about 20 miles north of Ottawa. Its dark color distinguishes it from *allecta* Needh., from which it also differs in genitalic characters, the apical portion of the penes being drawn to a long point, leaving the basal half broad and roughly diamond-shaped.

BAETINI.

Since my notes on the species of this interesting group found in the Ottawa region (Can. Ent. 1921, LIII, 117) I have continued my studies of them with particular attention to the living material. All three species mentioned in the above paper, *propinquus* Walsh, *intercalaris* McD. and *flavistriga* McD. occurred very plentifully in the neighborhood of the Rideau River during the summer of 1922; there are apparently two generations of each species, as I captured specimens in early June and again from the middle of August until early in September, the second generation being rather smaller in size than the spring one. In the living state the differences in the size of the turbinate portion of the eyes of the males is very noticeable and this, combined with differences in the color of the thorax and posterior segments of the abdomen makes a separation of the males fairly easy; the females, concerning whose identity I was uncertain in my former article, have now also been distinguished; I offer the following descriptions, drawn up from live material, to supplement the previous ones:—

Baetis intercalaris McD.

Male. Turbinate portion of eye large, lengthily oval, deep brown with upper part of stalk yellow; sessile portion of eye black. Face black with inner edge of ocelli, and a spot at the base of the eye, pale yellow-green. Antennæ black, paler at tip with basal joint ringed with yellow at apex. Thorax shiny blackish with lateral edge of mesonotum and posterior protuberances tinged with dull olivaceous; lateral sutures shaded with brown. Abdomen with segments 2—6 hyaline white, 7—10 dorsally umber brown, ventrally opaque white; in the spiracular area the tracheæ are lightly marked with black; setæ white. Legs dirty white, claws black.

*—Contribution from Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

Female. Can be distinguished in nature from the females of the other two species by its deep olive brown color and the dark venation of the wings which often have a purplish sheen.

Baetis propinquus Walsh.

Male. Turbinate eyes moderately large, oval, deep brown with upper half of stalk yellow; sessile portion blackish. Face black with light green shading only at base of antennæ; antennæ black with white ring at apex of first joint. Thorax black, shiny, the only traces of pale markings being in the lateral sutures. Abdomen hyaline whitish with segments 7—10 light sepia brown dorsally and opaque white ventrally. Spiracles black. Legs and setæ white, fore femur slightly smoky.

Female. Head olivaceous yellow, slightly marked with red-brown. Thorax dull olive brown marked slightly with yellowish laterally below wings. Abdomen pale yellowish with series of large subdorsal brown spots on segments 2—7, these spots tending to coalesce and form stripes; segments 8—10 unicolorous yellowish, spiracular area slightly marked with black. Legs white, setæ white. In contradistinction to the preceding and following species the veins of the primaries are pale.

Fig. 1. Relative size of turbinate eyes of *a. Baetis intercalaris* McD.; *b. Baetis propinquus* Walsh; *c. Baetis flavistriga* McD.

Baetis flavistriga McD.

Male. Turbinate eye on a long stalk; small, oval, light brown with a yellowish tinge (much lighter than in *propinquus* and *intercalaris*); stalk purple brown with upper third yellow. Face black with pale green markings around base of antennæ and ocelli; antennae blackish. Thorax dark olivaceous (paler than in *intercalaris*) with yellowish shades on the pronotum and an oblique streak along the lateral edge running forward from base of wing; considerable pale yellow markings on the lateral sutures. Abdomen hyaline tinged with pale yellow-brown on segments 2—6, the posterior segments being light umber brown, the contrast between the two colors not being so marked as in the two preceding species; ventrally paler with last segments opaque creamy; spiracular area slightly marked with black. Legs with all the femora pale yellow; other portions dirty whitish.

Female. Head yellow, tinged considerably with dirty olive-brown. Antennæ with basal joint yellow, second joint brown. Thorax and abdomen pale (occasionally dark) olive-brown; prothorax edged with yellow, mesothorax with yellow streak as in male and with posterior protuberances often tinged with yellow; laterally there is considerable yellow shading, noticeably a patch in front of the wings. Abdomen with narrow yellow intersegmental rings; ventrally

paler with last two segments shaded with creamy. Setæ white, smoky at base. Legs smoky with femora tinged with olivaceous.

Besides *Baetis unicolor* Hagen, which in the ♂ sex has the abdomen entirely brown, as in the ♀, several other undescribed species have been discovered in the course of our collecting. A description of these follows:

Baetis phoebus sp. nov.

Male. Turbinate eyes (in living specimen) large, long-stalked, broadly oval, almost circular, upper surface red-brown with a narrow yellow rim. Head and thorax (dried specimen) brown, latter with a yellow streak extending from base of primaries to anterior prominence of mesonotum along lateral edges of same; rear portion of meso- and anterior portion of the metathorax variably shaded with light ochreous; lateral sutures more or less marked with ochreous. Abdomen with segments 1—6 whitish hyaline with very faint olivaceous tinge (less than in *flavistriga*); segments 7—10 bright brown, slightly ruddy dorsally, opaque whitish ventrally, variably tinged with brown; spiracular flange slightly dotted with blackish. Legs very pale yellowish. Wings hyaline with pale cross-nervures; intercalaries well-developed; pair between subcosta and radius no longer than those following; hind wings broad, well developed.

Female. Pale olive or yellowish, ventral portion of abdomen lighter in color than dorsum. Primaries with cross-nervules light brown. Length of body 5 mm.; of fore-wing 5½ mm.

Holotype—♂, Ottawa West, May 25th, 1921 (A. W. Richardson); No. 527 in the Canadian National Collection, Ottawa.

Allotype—♀, Ottawa West, May 27, 1921 (J. McDunnough); in the Canadian National Collection, Ottawa.

Paratypes—9 ♂, 3 ♀, taken by the above collectors in the same locality on May 25 and 27, in the Canadian National Collection.

The species is closely allied to *flavistriga* McD., but is considerably larger; the turbinate eyes are noticeably larger and the pale portion of the abdomen contrasts more with the brown posterior portion, due to the practical lack of olive shading such as is found in *flavistriga*. The specimens were all taken along a small creek just west of the city limits and the females are presumed to belong to this species. Unfortunately building operations have spoiled the collecting ground. Several specimens of what appears to be this species have been taken on our office window at various times, but the series is not large enough for a definite determination.

Baetis dardanus sp. nov.

Male. Very similar to *propinquus* Walsh, but slightly larger and with turbinate portion of eyes also larger. Thorax dark shiny black-brown, as in *propinquus*, with lateral sutures marked in whitish. Abdomen with segments 2—6 hyaline whitish, segments 7—10 brownish-olive (Ridgway Pl. XXX, m) dorsally, opaque white ventrally, shaded with brown; forceps whitish. Along the spiracular line, instead of the black dots of *propinquus* is a faint, ruddy shade. Legs pale yellowish, setæ white. Wings hyaline, the secondaries not angled on costa near base as in *propinquus* but evenly rounded, leaf-shaped.

Female. Light olivaceous, hardly to be distinguished from the same sex

of *propinquus* except by the characteristic shape of secondaries. Length of body 5 mm.; of fore wing 5½ mm.

Holotype—♂, Aweme, Man., June 11, (N. Criddle); No. 528, in the Canadian National Collection, Ottawa.

Allotype—and 2 ♂ *Paratypes,* same data, in the Canadian National Collection, Ottawa. In the National Collection is also a single specimen from Ottawa, Ont. (Aug. 22; J. McDunnough) which agrees with the above in shape of secondaries and general appearance. Without more material, however, it is unwise to place it under this name definitely.

Baetis nanus sp. nov.

Male. Turbinate eyes small, oval, slightly smaller than in *flavistriga* McD., in living specimens pale yellow-brown, in dried ones bright red, marked with yellowish around rim. Thorax pale olivaceous, at times tinged with smoky posteriorly and with brownish shades on anterior sutures. Abdomen with segments 2—6 semihyaline, dorsally yellowish, with at time faint brown tinges, ventrally dull, pale ochreous, lateral area most noticeably hyaline with spiracular line streaked and spotted with black; segments 7—10 more opaque and shaded dorsally with isabella brown (Ridgway Plate XXX, i); setæ whitish. Femora yellow; remainder of legs dull hyaline whitish. Wings hyaline. Length of body 3 mm.; of forewing 4 mm.

Holotype—♂, Ottawa, Ont., Aug. 19, 1922, (J. McDunnough); No. 529, in the Canadian National Collection, Ottawa.

Paratypes—4 ♂, same data, in the Canadian National Collection, Ottawa

The specimens were all captured on bushes near the banks of the Rideau River; while the species is close to *flavistriga* it may be readily separated by the color of the eyes in the live ♂, the paler thorax and yellower dorsal area of abdominal segments 2—6. I have not yet succeeded in differentiating the ♀, but have two ♂ specimens taken May 18, 1921, which may represent the spring generation; they are slightly larger and darker colored than the types.

Centroptilum fragile sp. nov.

Male. (living). Eyes with turbinate portion large, narrowly oval, almost kidney-shaped, pale yellow-brown; basal half of stalk purplish with yellow band; sessile portion dull greenish. Face yellowish above and between the ocelli; antennæ light smoky with white base. In dried specimens the turbinate eyes shrivel to bright red lunate disks between which the front appears as a dark gray oval with a V-shaped incision at apex.

Thorax shiny black-brown with pale markings on posterior protuberances; lateral area browner with pale markings at base of wings. Abdomen whitish hyaline slightly streaked with black, especially in stigmatal area; dorsally segments 7—10 rather bright brown, ventrally opaque white; anterior segments slightly tinged with brown and with faint brown intersegmental rings. Legs white. Wings hyaline with single intercalaries.

Female. Head pale yellowish with slight brown striation; ocelli ringed with brown. Thorax light olivaceous with creamy markings on posterior edge of prothorax and lateral edges of mesothorax anterior to the wings; dorsal protuberance white; white edging to metanotum. Abdomen pale yellow-green with

black tracheæ and slight whitish intersegmental rings; ventrally still paler. Length of body 4 mm.; of fore wing 5 mm.

Holotype— ♂, Rideau River, Ottawa, Ont., Aug. 22, 1922 (J. McDunnough); No. 530, in the Canadian National Collection, Ottawa.

Allotype— ♀, same data, in the Canadian National Collection.

Paratypes—3 ♂, same locality and collector, Aug. 16, 1922, in the Canadian National Collection, Ottawa.

A smaller species than *luteolum* Mull, which Eaton records from the Hudson Bay region and with which description two females from Nordegg, Alta., seem to agree; the male forceps lack entirely the conical basal protuberance of *luteolum* said to be characteristic of the species, they resemble closely Eaton's figure (Pl. XVII, fig. 30b) of *C. pennulatum* Eaton.

Centroptilum curiosum sp. nov.

Male. (living). Turbinate portion of eyes large, lengthily oval, deep brown with upper half of stalk pale yellow; sessile portion black. Head black. Thorax shiny black shaded laterally below the wings with brown. Abdomen with segments 1—5 hyaline, shaded slightly dorsally with pale greenish yellow and with a small, round red-brown spot on segments 2 and 3, rarely on 4 and 5; segments 6—10 dorsally light sepia brown, this shading at times extending forward as far as segment 3; ventrally shaded with opaque white; spiracular area often marked with black. Forceps white; setæ white, ringed on basal segments with red-brown. Legs whitish, fore-femora blackish, fore tarsus quite short and only equal to about three-fourths the length of tibiae. Wings hyaline; primaries with two intercalaries, fairly well developed except between Sc. and R and between the anal veins; hind wing present but reduced to a mere thread, much narrower than is typical for *Centroptilum*.

Female. Paler than the male; thorax olive brown; abdomen dirty olive green with segments 2—5 slightly tinged dorsally with yellowish and with brown dots on 2 and 3; segments 6—10 shaded with brown. Length of body 4½—5 mm.; of fore-wing 5—5½ mm.

Holotype— ♂, Ottawa, Ont; Aug. 22 (J. McDunnough) No. 531, in the Canadian National Collection, Ottawa.

Allotype— ♀, same data, in the Canadian National Collection, Ottawa.

Paratypes—14 ♂, 6 ♀, same locality and collector, Aug. 21, 22, 23, in the Canadian National Collection, Ottawa.

The shortness of the fore-legs, the paired intercalaries of the primaries, and the almost entire reduction of the secondaries may call for a new generic name, but for the present I place the species in *Centroptilum*.

The genus *Clocon* falls into two sections, according to whether the intercalary veins of the primaries are single or paired; the first section is the typical one, contains *vicina* Hag. and *mendax* Wlsh., and seems closely allied to *Centroptilum*. The second section has more affinity to *Bactis* and is represented by *dubia* Wlsh. Several new species occur in Canada which are described as follows:

Section I.

Cloeon rubropicta sp. nov.

Male (dried). Head blackish brown, turbinate eyes long, narrowly oval, shrivelling so as to form lunate lateral disks, leaving the central portion of the

head free, as mentioned under *Centroptilum fragile*; antennae with pale basal joints. Thorax deep brown, slightly ruddy along sutures and edges of meso- and metanotum. Abdomen with segments 2—6 pale yellowish white, segment 2 dorsally with a ruddy inverted "Y" mark, segments 3—6 with slight traces of a ruddy median line and with small subdorsal red dots placed near the segmental incisures; laterally the stigmatal flange is marked by a broken black line and above this are faint red dots, one in the centre of each segment; dorsally segments 7—10 bright red-brown with setæ and forceps whitish; ventrally the posterior segments are opaque whitish; legs entirely pale yellowish white. Wings hyaline with single intercalary veinlets.

Female. Head yellowish; thorax light ochreous to olive brown, shaded below the wings with deeper brown. Abdomen dorsally much the same color as thorax, paling on posterior segments, except 10, which is ruddy; the subdorsal red dots extend along the entire abdomen; black spiracular line as in ♂; ventrally thorax and abdomen entirely pale yellowish; legs yellowish. Length of body, ♂, 3 mm., ♀, 4 mm.; of wing, ♂ 4 mm.; ♀, 5½ mm.

Holotype—♂, Ottawa, Ont., Aug. 19, 1922, (J. McDunnough); No. 532, in the Canadian National Collection, Ottawa.

Allotype—♀, Ottawa, Ont., June 14, 1920 (J. McDunnough), in the Canadian National Collection, Ottawa.

Paratypes—12 ♀, Ottawa, Ont. (June 9, 11, 14, 1920; Aug. 16, 19, 22, 1922) (J. McDunnough); 2 ♂, 1 ♀, Norway Pt., Lake of Bays, Ont. (July 14, 1920; July 1, 1922) (J. McDunnough).

Cloeon ingens sp. nov.

Male. Head smoky, tinged with ruddy; basal joints of antennæ dusky; eyes shrivelled as in preceding species, discolored. Thorax shiny blackish with the sutures tinged with ruddy brown; laterally below the rings heavily shaded with pale brownish. Abdomen with segments 2—6 dorsally dull olive brown, semi-hyaline with the segmental incisures faintly ringed in black and with black markings along spiracular flange; segments 7—10 deep chocolate brown; ventrally dirty whitish with posterior segments opaque and slightly shaded with brown, setæ and forceps whitish, the former tinged with ruddy at base. Legs smoky brown. Wings hyaline with single intercalaries.

Female. Thorax and abdomen above olive-brown shaded with ruddy, especially posterior three segments of abdomen, which are almost entirely ruddy and show traces of maculation in the shape of curved, pale subdorsal lines on anterior portion of each segment. Venter and legs pale ochreous. Length of body 8 mm.; of wing 9 mm.

Holotype—♂, Nordegg, Alta., Aug. 3, 1921, (J. McDunnough); No. 533, in the Canadian National Collection, Ottawa.

Allotype—♀, Banff, Alta., Aug. 4, 1922, (C. B. Garrett), in the Canadian National Collection, Ottawa.

The two sexes may not be correctly associated, but similarity of size and general habitat leads me to place them together. It is the largest species as yet reported from North America.

Section II.

The commonest *Clocon* species found along the Rideau River at Ottawa

is one to which I am applying the name *dubia* Walsh. As stated by the author, it bears a marked similarity to *Baetis propinquus* Wlsh., but lacks hind-wings and is smaller; the males of our Ottawa specimens do not possess the black lateral spiracular dots mentioned by Walsh, but often show a faint, dark spiracular line; the turbinate eyes are considerably smaller than in *propinquus* and almost circular, in living specimens the upper surface is ruddy brown; the thorax is shiny black and the abdomen hyaline with segments 7—10 dorsally pale umber brown, rather paler than in *propinquus*. The species is double-brooded, occurring in May and June and again in August and September.

Two other closely allied species have been taken sparingly along with *dubia*; the one is distinguished by its larger turbinate eyes and by the presence of a row of minute dots centro-ventrally on the abdomen, the second, which has only been captured in August, differs markedly in the living state by the color of the turbinate eyes, which are yellow-green. I propose the following names for these:

Cloeon punctiventris sp. nov.

Male (living). Turbinate eyes almost circular, larger than in *dubia* Wlsh., light yellow-brown, stalk paler and ringed with purple-brown just above base. Face blackish, base of ocelli and antennæ tinged with pale yellowish green; antennæ black, paling towards tip, first joint with pale apical ring. Thorax blackish with light olive shading laterally and slight greenish markings on anterior portion and lateral edge of mesothorax and on the dorsal protuberances. Abdomen hyaline whitish with segments 7—10 light brown (rather ruddier than in *dubia*) dorsally and opaque white ventrally; faint black spiracular dots on the pale segments and a centro-ventral row of minute dots placed on the posterior margin of each segment. Setæ white. Legs whitish, fore femora generally tinged with smoky. Wings hyaline with paired intercalaries.

Female (dried). The single female which I incline to associate with the above ♂ has the head, thorax and dorsal surface of abdomen light olivaceous brown; the ventral abdominal region is whitish with the centro-ventral row of brown dots much larger than in the ♂. Length of body 3—4 mm.; of wing 4—4½ mm.

Holotype—♂, Rideau River, Ottawa, Ont., Aug. 19, (J. McDunnough); No. 557 in the Canadian National Collection, Ottawa.

Allotype—♀, Ottawa, Ont., June 4, (J. McDunnough), in the Canadian National Collection, Ottawa.

Paratypes—5 ♂'s, same locality and collector, June 3, Aug. 19, 22, in the Canadian National Collection.

There is also a vial containing ten ♂'s of this species in alcohol, collected on May 20, 1921, which may be considered as Paratypes. As is usual in this group, the spring specimens are somewhat larger than the fall ones.

Cloeon chlorops, sp. nov.

Male (living). Turbinate eyes similar in size to those of *dubia*; yellow-green with a purple-brown band at base of stalk (in dried specimens the eye appears deep purplish with a broad outer edging of pale red-brown). Head shiny black, ringed with greenish around antennæ and ocelli; thorax blackish, shiny, with pale lateral sutures and slight greenish shades on anterior portion of mesothorax; abdomen hyaline with faint yellowish tinge, segments 7—10 pale

brown (rather ruddier than in preceding species) the color extending more or less over ventral surface; a faint brown spiracular line. Setæ white. Legs whitish with smoky fore femora. Wings hyaline with paired intercalaries. Length of body 3 mm.; of wing 4 mm.

Holotype—♂, Ottawa, Ont., Aug. 16, (J. McDunnough); No. 558 in the Canadian National Collection, Ottawa.

Paratypes—8 ♂'s, same data, in the Canadian National Collection, Ottawa.

Cloeon virilis sp. nov.

Male. Head blackish; eyes (dried) large, oval, deep red-brown; antennae blackish. Thorax shiny black with the anterior lateral edge of the mesonotum to base of wing with pale yellow streak; lateral and ventral sutures slightly pale-marked. Abdomen with segments 2—6 hyaline, dorsally with faint tinge of ruddy on segmental incisures and two minute, red subdorsal dots on anterior part of each segment; laterally the tracheæ of the stigmatal area are strongly outlined in black, segments 7—10 dorsally chocolate brown; ventrally entire abdomen pale with faint, medio-ventral ruddy dots on segments 5 and 6 and considerable ruddy shading on 7 and 8; forceps and setæ pale. Fore-leg with femur and base of tibia smoky yellow, remainder pale whitish; other legs whitish with apex of femur and a median band pale purplish-red. Wings hyaline with paired intercalaries. Length of body 4 mm.; of wing 5½ mm.

Holotype—♂. Ottawa, Ont., June 7, 1922, (J McDunnough); No. 534, in the Canadian National Collection, Ottawa.

A larger and chunkier species than any so far taken at Ottawa.

SIPHLONURINI.

The key as given by Needham (Bull. 86, N. Y. Sta. Mus., 25, 1905) for the separation of the *Siphlonurus* group of genera is not entirely satisfactory and is capable of misinterpretation by one unfamiliar with the species of this group. His first main subdivision is as follows:

g. Median caudal seta a distinctly segmented rudiment; forceps of male three-jointed; posterior prolongation of sternum of ninth segment of abdomen of female bifid at tip.

gg. Median caudal seta more rudimentary or wanting; forceps of the male distinctly four-jointed; posterior prolongation of the sternum of the ninth abdominal segment in the female entire at tip.

Under the first heading he places *Coloburus* and *Chirotenetes* (*sic*); under the second *Siphlurus* (*sic*) and *Ameletus*.

The segmentation or non-segmentation of the aborted median caudal seta is a poor character on which to separate two main groups, especially when dried material is being examined. I have found specimens of *Siphlonurus triangularis* Clem. which show a distinct segmentation of this seta and other specimens, which undoubtedly fall into Needham's *Chirotenetes*, possess an almost entirely aborted seta, with no trace of segmentation. The characterization of the male forceps as three and four-jointed is misleading; in *Siphlonurus triangularis* Clem., for instance, only three joints can be distinguished, the basal one being doubtless fused with the ventral plate, whilst in some species of *Chirotenetes* the splitting of this plate into two lobes certainly gives the appearance of a basal fourth joint.

Finally, while the bifid nature of the ninth abdominal plate in the female is very pronounced in *Chirotonetes*, it is also very slightly noticeable in the type species of *Ameletus* (*subnotatus* Eaton), and the character must be used with caution. As a basis for primary separation I find it more satisfactory to use a character found in the tarsal claws; the dissimilarity of these claws in each tarsus separates *Ameletus* (and incidentally *Coloburus*, which is not a North American genus) from *Siphlonurus* and *Chirotonetes*. To separate the two latter genera the position of the fork of the median vein of the hind-wing can be used very advantageously; this character has the advantage of being readily seen and of being present in both sexes. In this connection it may be stated that *Chirotonetes* Eaton (misspelt *Chirotenetes* by Needham and others) will fall to *Isonychia* Eaton; this latter generic name was proposed in 1871 (Trans. Ent. Soc. Lond., 134) for *manca* Eaton and *ignota* Wlk.; in 1881 (Ent. Mon. Mag. XVIII, 21) Eaton proposed the name *Chirotonetes* to replace *Isonychia*, under the impression that it was preoccupied by *Isonychus* Mannh., and used this term in his monograph (1885, Mon. Rec. Eph. 203) with type specified as *ignotus* Wlk. As, however, under the international Rules of Nomenclature, *Isonychia* Eaton is perfectly valid, it must again be used, with *Chirotonetes* as synonym, and *generic* type, *ignota* Wlk.

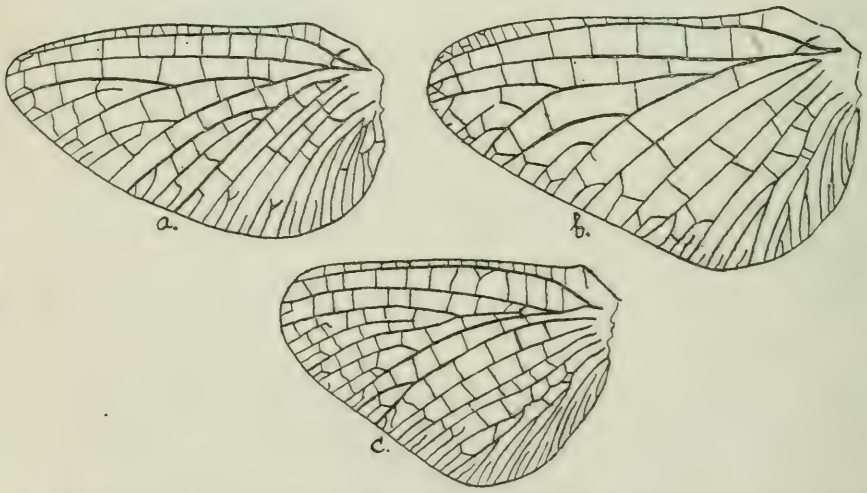

Fig. 2. Hindwings of *a. Siphlonurus triangularis* Clem.; *b. Siphlonuroides crocsus* McD.; *c Isonychia mancus* Eaton.

The median vein of the hind-wing, mentioned above, is forked for fully half its length in *Siphlonurus*, whereas in *Isonychia* it is quite short and the fork occurs in the outer fourth of the vein; in still another group, which seems of generic value, there is no fork at all, and for such species I propose the term *Siphlonuroides*. *Siphlonisca* Needh., which has not yet been reported from Canada, may be separated by the broad expansions of the abdominal segments and *Siphloplecton* Clem. (1915, Can. Ent. XLVII, 258) obviously falls into the Heptageninæ, as it shows the two pairs of intercalaries between the first and second anal veins; in fact the type species, *flexus* Clem., is a synonym of *basalis* Wlk. treated by Eaton under *Heptagenia* (Mon. Eph. p. 298).

For separation of our Canadian genera in this group the following key is offered:—

1. Claws of each tarsus dissimilar ..... *Ameletus.*
   Claws of each tarsus similar ..... 2.
2. Median vein of secondaries unforked ..... *Siphlonuroides.*
   Median vein of secondaries forked ..... 3.
3. Fork of median vein of hind-wings long, occurring at about half its length; posterior prolongation of sternum of ninth abdominal segment in female entire at tip ..... *Siphlonurus.*
   Fork of median vein of hind-wings short, occurring at about three-fourths of its length; posterior prolongation of sternum of ninth abdominal segment in female bifid at tip ..... *Isonychia.*

Siphlonuroides gen. nov.

Similar in general characters to *Siphlonurus* Eaton, but distinguished by the lack of a fork to the median vein of hind wings. Type of genus; *S. croesus* sp. nov.

Siphlonuroides croesus sp. nov.

Male. Head pale yellowish, marked with black at base of ocelli and along the central ridge. Thorax dull brown, the mesothorax shaded with yellowish anteriorly, most prominently along the median suture; a broad black line from base of primaries to lateral edge of prothorax, bordered on each side by yellowish; posterior portion of meso- and metathorax shaded with pale orange with the central tubercle blackish. Abdomen dorsally dull brown with lateral triangular pale patches on anterior portion of each segment; these pale triangles are improminent on the first seven segments, and are semi-transparent; on the three last segments they are brighter yellow and more opaque, especially prominent on the tenth segment; traces of subdorsal dark streaks, especially on posterior segments; ventrally the abdomen is yellowish with a large brown quadrangular patch on each segment which leaves the ground color only visible along the anterior margin and as a lateral triangular patch; ninth segment entirely brown except a small, yellow anterior triangle. Forceps and basal plate brown, the latter deeply notched on posterior margin. Setæ black-brown with slightly deeper colored rings marking the segmentation. Fore-legs deep brown, femur paler along upper margin and at apex; mid and hind legs dull olive-brown with darker tarsi. Wings hyaline with dark veins, primaries clouded with pale umber brown over the inner two-thirds of the wing, except for the costal half of the wing at the extreme base, which remains colorless; secondaries with an umber-brown shade along the costa.

Female. Head yellow, bordered anteriorly by a dark band and with subdorsal dark brown bands from rear of each lateral ocellus to posterior margin of head. Maculation of body similar to that of the male, with the subdorsal dark streaks better defined. Wings without any umber brown shade. Length of body 12—13 mm.; of fore-wing 13 mm.

Holotype—♂, Ottawa, Ont., May 22, 1922, (J. McDunnough); No. 522, in the Canadian National Collection, Ottawa.

Allotype—♀, same data, in the Canadian National Collection, Ottawa.

Paratypes—1 ♂, 2 ♀, same locality and collector, May 22; 2 ♀, May 29, in the Canadian National Collection, Ottawa.

Siphlonuroides midas sp. nov.

Male. Head blackish; thorax olive brown, shaded with paler yellowish olive anteriorly in median line, and on the posterior tubercle of the mesothorax. Abdomen dorsally brown with the segmentations distinctly marked in blackish, ventrally duller and paler brown with only the faintest trace of maculation, in the shape of small lateral darkish spots on each segment; setæ brown with darker intersegmental rings. Legs olive brown, the fore legs deeper in color than the others. Wings hyaline with dark veins, a faint trace of brown shading on primaries between subcosta and vein R_1 at basal half of wing, a brown dot at base above inner margin and a very faint shade along costa before apex of wing.

Female. Head yellowish with broad, dark brown median band; abdomen ventrally with segments marked narrowly in pale ochreous; wings hyaline with faint brownish tinge along costa for entire length. Otherwise as in male. Length of body ♂, 10 mm., ♀ 8 mm.; of fore-wing 10 mm.

Holotype— ♂, Ottawa, Ont., May 29, (J. McDunnough); No. 523, in the Canadian National Collection, Ottawa.

Allotype— ♀, same data, in the Canadian National Collection, Ottawa.

Siphlonurus berenice sp. nov.

Male. Head brownish, paler on the face; thorax dull brown with pale, clay-colored shading in medio-dorsal area. Abdomen brown dorsally with the usual pale triangular patches laterally, the last three segments more opaque and paler; ventrally pale brown, semi-transparent, except on last three segments, which are opaque and shaded with ochreous; forceps dull smoky in apical portion. Legs pale olive brown; fore-legs with the tarsal joints very long, subequal and tibia only slightly longer than first tarsal joint. Wings hyaline with dark veins, very slightly tinged with pale brown along apical portion of costa. Length of body 10 mm.; of fore-wing 10 mm.

Holotype— ♂, Cascades, Gatineau River, Quebec, June 13, (J. McDunnough); No. 524, in the Canadian National Collection, Ottawa.

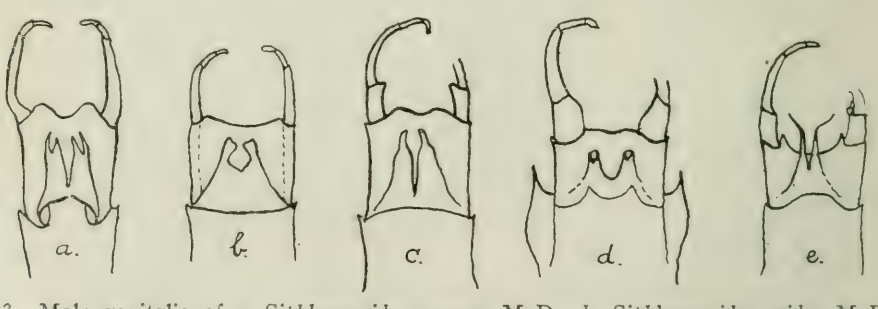

Fig. 3. Male genitalia of *a. Siphlonuroides croesus* McD.; *b. Siphlonuroides midas* McD.; *c. Siphlonurus berenice* McD.; *d. Siphlonurus phyllis* McD.; *e. Ameletus validus* McD.

Siphlonurus phyllis sp. nov.

Male. Head and thorax black brown, the latter shaded somewhat with yellowish anteriorly. Abdomen dark brown dorsally with the usual subdorsal dark streaks and a bifid patch of yellow laterally on the anterior margin of each segment, becoming more extended on posterior segments; ventrally yellowish, very characteristically marked with a brown median stripe flanked by a large brown dot on anterior portion of segment and a smaller dot in central portion

of segment, which generally touches the median stripe; some slight brown shading along spiracular flange, ninth segment largely pale yellow with a deep brown lateral streak and diffuse brown shading in median area, especially at base of segment, lateral edge produced to a prominent sharp tooth; ventral plate squarely truncate; forceps pale ochreous. Setæ whitish. Legs dull olive brown, femora banded with brown. Wings hyaline with dark veins and with very faint tinges of pale brown in basal area.

Female. Very similar in maculation to the male. Ventral prolongation of ninth abdominal segment small and evenly rounded; with the exception of segments eight and nine, the ventral area is considerably clouded with brown, but the maculation remains distinct. Length of body, ♂, 12 mm.; ♀, 13 mm.; of fore-wing ♂, 12 mm.; ♀, 14 mm.

Holotype—♂, Banff, Alta., July 26, (C. B. Garrett); No. 525, in the Canadian National Collection, Ottawa.

Allotype—♀, Banff, Alta., July 25, (C. B. Garrett); in the Canadian National Collection, Ottawa.

Ameletus validus sp. nov.

Male. Head discolored; thorax deep black-brown, shiny, tinged with light brown on anterior sutures of mesothorax and in the area adjacent to the posterior tubercles. Abdomen pinkish brown, the first six segments semi-transparent with narrowly opaque sutures; segments 7—10 opaque, segment 9 being shaded laterally with smoky brown; abdominal plate brown, with paler lateral edges and a light ochreous median area, posterior margin strongly excavated medianly with a small tooth on either side of the concavity; forceps smoky brown. Prolegs deep black brown, other legs similar in color to abdomen. Wings hyaline with dark veins, faintly clouded with light umber brown, palest along outer margin. Length of body 10 mm.; of fore-wing 11 mm.

Female. With more extended pale thoracic shading and no cloud on wings.

Holotype—♂, Banff, Alta., Oct. 1 (C. B. Garrett); No. 526, in the Canadian National Collection, Ottawa.

Allotype—♀, Banff, Alta., Sept. 20 (C. B. Garrett); in the Canadian National Collection, Ottawa.

Paratype—1 ♂, Banff, Alta., Sept. 30 (C. B. Garrett); in the Canadian National Collection, Ottawa.

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POPULAR AND PRACTICAL ENTOMOLOGY

FORECASTING OUTBREAKS OF THE PALE WESTERN CUTWORM IN ALBERTA*

BY H. L. SEAMANS,

Entomological Branch, Ottawa.

The Pale Western Cutworm (*Porosagrotis orthogonia* Morrison) has been causing serious losses to grain crops in Alberta since 1911 and has appeared in certain sections of the prairies in the United States since 1915 in injurious numbers. Owing to its peculiar habit of feeding almost entirely below the surface of the ground, ordinary control measures have, on the whole, proved useless. The important control at present consists of cultural practices designed to prevent oviposition in fields to be cropped the following season.

Since the Pale Western Cutworm seldom comes to the surface of the soil, and usually feeds only on the more tender underground portions of the plants, parasitism is usually low. Predatory insects and birds are the most persistent enemies but their combined efforts are almost negligible as control factors under dry weather conditions.

It has been noticed frequently that the percentage of parasitized cutworms varies greatly from year to year as does the number of species of insects responsible for parasitism. This was especially true in 1915 when Mr. E. H. Strickland, at that time Entomologist in charge of the Dominion Entomological Laboratory at Lethbridge, Alberta, made the prediction that owing to the high percentage of parasitized cutworms collected during that summer in southern Alberta there would be no outbreak in 1916. During the past season (1922) observations have been made by the writer in the vicinity of Lethbridge, Alberta, which show a similar condition, though the general parasitism does not indicate that there will be a total absence of cutworms next season but rather that a substantial reduction in the numbers will occur. The most striking observation was not the high percentage of parasitized larvae but the large number of species of parasites involved. Under the weather conditions that have existed in southern Alberta for the last five years, the main parasites of *P. orthogonia* have been two species of tachinids and an occasional braconid. The rearing records for 1922 show that in addition to these parasites there also occurred a bombyliid, a chalcid, two ichneumonids, and another tachinid, all being species which are commonly associated with surface feeding noctuids. There was nothing to indicate that these parasitic insects were any more numerous than usual, but the conditions for their obtaining access to the larvae of *P. orthogonia* were more favorable. It is known that wet weather brings the larvae of the

*—Contribution from the Division of Field Crop Insects, Entomological Branch, Dept. of Agric., Ottawa.

Pale Western Cutworm to the surface of the ground where they remain until the surface soil starts to dry out. Such weather conditions occurred frequently throughout May and June, 1922, the normal period of activity of the larvae and at these periods they were at the mercy of many of the parasitic insects which seldom reach them under the surface. It is also noticeable that when the soil is wet the cutworms feed on the entire plant instead of only on the tender portion below ground. This increases the chances of parasitism from eggs deposited by those species of parasites which normally lay on the foliage of the plant.

There has apparently been no increase or decrease in the numbers of parasites from year to year but the increase in parasitized *P. orthogonia* larvae can be distinctly correlated with the number of days in May and June when cutworms are forced to the surface because of moisture. It should be possible to determine to some extent the presence or absence of cutworms for any year by the number of wet days during the preceding May and June combined.

Under normal conditions for May and June in the vicinity of Lethbridge, 0.25 of an inch of rain is sufficient to make a "wet" day, which can best be defined as a day when the soil is too wet to be easily worked and cutworms are moving about on the surface. The amount of moisture which constitutes a wet day will vary with the subsequent weather conditions and the type of soil. These must be taken into consideration when any work is being done with precipitation records. Accurate information can only be secured by checking the days at the time of taking the weather observations. A review of the daily precipitation records for May and June at Lethbridge, Alberta, from 1909 to 1922, gives the following results in "wet" days for two months.

Year	*Number of Wet Days*
1909	10
1910	2
1911	15
1912	5
1913	15
1914	4
1915	18
1916	19
1917	6
1918	2
1919	6
1920	5
1921	5
1922	10

A review of the reports of Pale Western Cutworm abundance at Lethbridge shows that they first appeared in injurious numbers in 1911, which followed 1910 with only two days wet enough to bring the larvae to the surface. With 15 wet days in 1911 it was found that the infestation dropped to almost nothing in 1912 but rose again in 1913 and dropped in 1914. In 1915 there was a heavy infestation but the excessive moisture caused much of the grain to

recover after being cut, and the loss was very small. The two years of 1916 and 1917 were practically free of any cutworm infestation, but 1918 showed a marked increase, which reached a climax in 1922. The damage during 1922 was not severe because of the opportune rainfall, which caused grain to recover after being cut by the larvae.

Since Lethbridge is the only place in Alberta where Pale Western Cutworm infestation reports and daily precipitation charts are complete and authentic, it was necessary to secure records from Montana in order to amplify and supplement our notes. The daily precipitation records were secured from the U. S. Weather Bureau station at Helena, Montana, and other sources, while the cutworm distribution data were kindly furnished by the Montana Experiment Station at Bozeman.

Weather records from eighteen localities in Montana where cutworm distribution reports are also available show almost the same result as the Lethbridge observations. These records cover a period of six years for many localities, and there are well over one hundred instances by which it is possible to check the number of wet days with the increase or decrease of cutworms.

A review of all the data shows that any year which has less than ten wet days in May and June is followed by corresponding increase in the infestation of *P. orthogonia*. Years which have from ten to fifteen wet days are followed by some decrease, while years with more than fifteen wet days are followed by an almost total disappearance of the pest. It must be remembered that these wet days are obtained from tabulated data with little knowledge of the accompanying weather conditions and that actual observations might change the results to a certain extent. This past season the weather records for Lethbridge showed ten wet days, where as an actual fact there were fourteen days when cutworms were moving about on the surface for some part of the day, and this same fact might apply to any year of any locality.

It must be noted that while rain is actually falling, parasites are not active, but the two tachinids, *Bonnetia compta* and *Gonia capitata*, which are the most abundant of the parasites of *P. orthogonia*, lay their eggs on the leaves of vegetation. The increase of these species in parasitized cutworms is due to the fact that wet weather causes the cutworms to feed on the leaves above ground. The direct parasites become active as soon as the rain is over, and, while being the chief instruments of control with the common surface feeding cutworms of many species, are an important factor in the control of *P. orthogonia* during that period when they are on the surface following rain and previous to their return beneath the soil.

This basis for forecasting the presence of *P. orthogonia* in districts where it is known to occur to some extent, is apparently sufficiently accurate for all practical purposes, to enable every farmer to determine for himself by July first whether or not these cutworms will be present in injurious numbers the following year. When he has made this determination he can govern his cultural practices for the remainder of the summer in a way to avoid undue losses the following season.

SOME STUDIES ON THE GENUS HYDROMETRA IN AMERICA NORTH OF MEXICO WITH DESCRIPTION OF A NEW SPECIES (HYDROMETRIDAE, HEMIP.)

BY H. B. HUNGERFORD,

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A short time ago I published a little note in the Bulletin of the Brooklyn Entomological Society calling attention to the presence in Kansas of both *H. martini* Kirk. and *H. australis* Say. It seemed to me important to note the fact in connection with *H. australis* Say, which had been recorded from Georgia, Florida and Louisiana only. The Kansas record therefore greatly increased the known range of this insect. The other species, *H. martini* Kirk., had been previously reported from Kansas (Hungerford, Kansas Science Bulletin XI), and is known to have a wide range over our country. The occurrence of *H. australis* Say in various parts of Kansas (Cherokee County, Douglas County and Riley County) suggests the likelihood that it, too, must have a considerable range and is being confused with *H. martini* Kirk. in various collections. These studies are presented to aid in a more satisfactory recognition of these insects by drawing attention to characters hitherto used in their differentiation, and to add a third species not previously described.

Say recognized two kinds of Hydrometra in this country: one which he called *H. lineata*, and the other, which he considered a variety of it, *H. lineata* var. a. *australis*. J. O. Martin, in 1900 (Can. Ent. XXXII, pp. 70—76), published a study on the life history of *Hydrometra lineata* Say and pointed out differences between it and the European *H. stagnorum*. Shortly after this, Kirkaldy (Entomologist XXXIII, pp. 175—190) reported that the name *H. lineata* Say was preoccupied by *H. lineata* Eschsch, 1822, from Manilla, and proposed the name *H. martini* Kirk. for this insect. In 1905, J. R. de la Torre Bueno (Can. Ent XXXVII, pp. 12—14) gave some rearing notes on *H. martini* Kirk., and from the study of a single male of Say's variety *australis*, pointed out specific differences between the two kinds, thus raising *H. australis* Say to specific rank. He also presented drawings of the terminal segments of the two species. Nevertheless, so far as I know, Professor H. G. Barber* is the only one who has reported *H. australis* since that time, and our knowledge of the tangible specific differences has rested upon Mr. J. R. de la Torre Bueno's study of the solitary male. The examination of numerous specimens of *H. australis* Say bears out his studies and justifies the addition of other characters for distinguishing the species.

The shape and position of the elevations on the ventral side of the sixth abdominal segment of the males serve to separate the three species (see Plate 1, Figs 7, 8 and 9). They may also be separated by the number and arrangement of the pits on the pleura above the coxæ.** The thorax of Hydrometra is more or less pitted, but the number of pits on the side of the bug above the coxæ is quite characteristic and fairly constant, sufficiently so to be of considerable help in determining the species and has the added value of pertaining to both sexes (see Figures 1, 2 and 3). The original descriptions of the two previously described species are short and therefore repeated here for the convenience of the worker, and amplified by more recent studies.

*—Bul. Am. Mus. Nat. Hist. XXVIII, p. 300, 1914.

**—I refer to those located on either side of the pro and mesocoxal clefts.

Hydrometra martini Kirk., 1900.

"Fuscous; hemelytra dull whitish with black nervures.

Inhabits United States.

Body fuscous, or brown, more or less deep; hemelytra dull whitish or dusky, with black nervures: wings opaque white, with black nervures: tergum pale, quadrilineate with black; two of the lines on the edge and the interval between the two inner lines dull whitish or bright yellow; the incisures of the segments more or less black: beneath and feet obscure yellowish: thorax with more or less obvious pale line.

"Length seven-twentieths of an inch.

"This is very much like the *stagnorum* F., but the hemelytra are not testaceous, and there is no thoracic impressed line.

"(*Male?*) Body blued-black; thorax with pale line; antennæ and feet dark honey-yellow; tergum and venter without lines."

Say's description from Complete Writings, Vol. 1 p. 361.

Notes:

J. O. Martin noted that the males of this species have the terminal segment abruptly swollen toward the tip as viewed from above, and that this bears a well marked spiniferous tubercle. He also noted the two thin, plate-like elevations on the ventral side of the sixth abdominal segment (see Figs. 5 and 12). A study of material from Kansas (various localities), Texas, Louisiana, Minnesota and New Jersey shows that the species is further characterized by having normally, two pits on the pleura above the pro- and mesothoracic coxæ in both sexes, and by the front femora usually not reaching the front of the head. Some species have faint, whitish spots on the sides of the abdomen, which in *H. australis* Say are very conspicuous. In fully winged specimens a longitudinal white line extends down the dorsum. In some this is very marked.

Hydrometra australis Say.

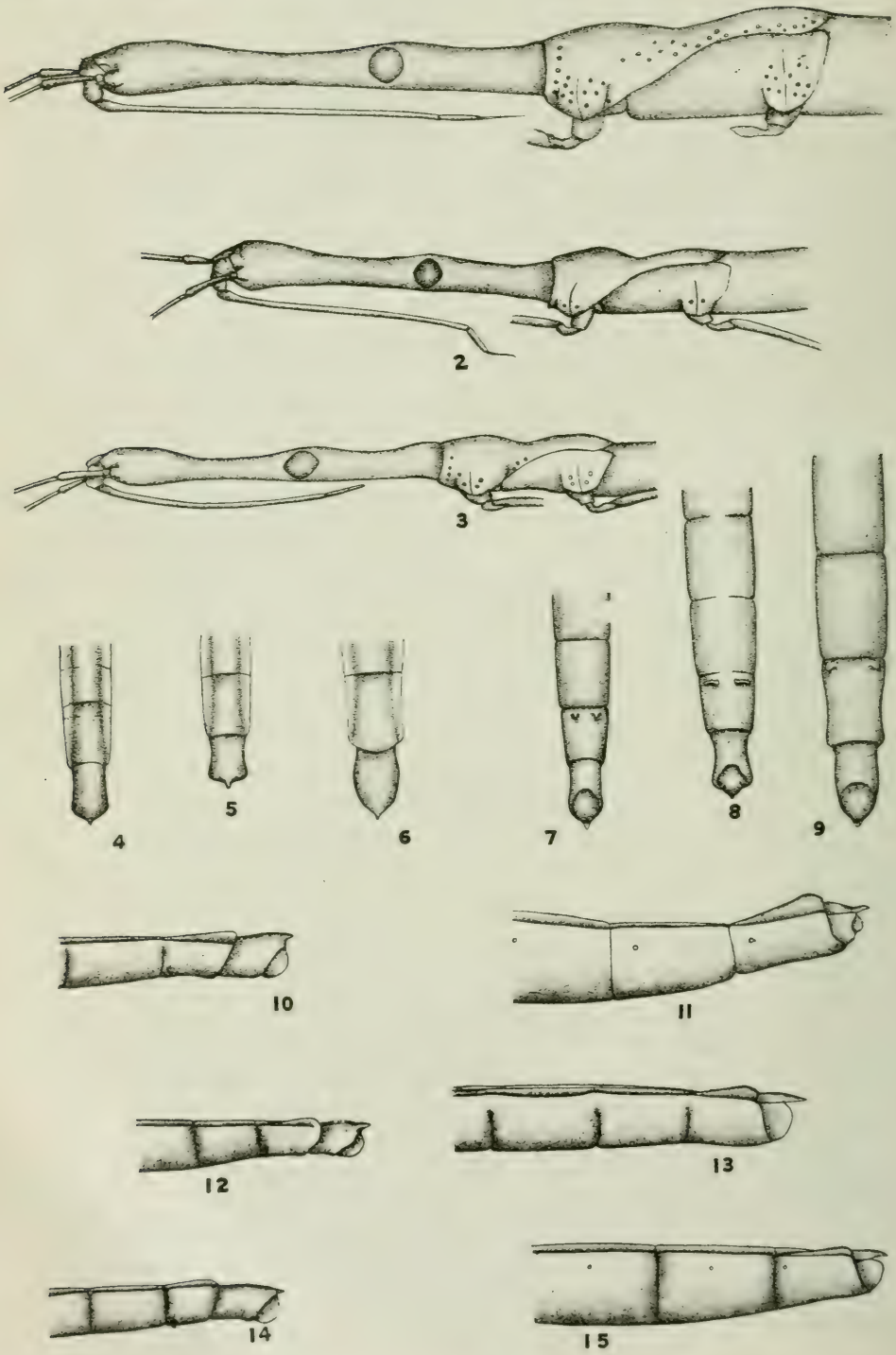
"Head beyond the eyes a little longer and a little more dilated at tip; second joint of the antennæ a little more dilated at tip; abdomen with five lateral whitish points.

"Inhabits New Orleans."

Say's Description from Complete Writings, Vol. 1, p 361.

Notes:

Bueno noted that the male terminal segment as seen from above is not abruptly swollen as in *H. martini* Kirk., that the tubercle it bears is not prominent and that the lateral margin is straight and not sinuate as in *H. martini* Kirk. This last is often difficult to see. Material from three localities in Kansas (Cherokee, Douglas and Riley Counties) shows that the males have on the ventral side of the sixth abdominal segment, two conical elevations instead of shallowly but broadly notched ridges (see Figs 7 and 8). The front femora are about as in *H. martini*. There are normally four pits above the pro- and mesocoxæ (see Fig. 3). Those on the mesothorax are more constant as to number and arrangement than those on the prothorax. The tip of the abdomen of the female is less elongate than that of *H. martini* Kirk.



NORTH AMERICAN HYDROMETRIDAE.

Hydrometra wileyi sp. nov.

Size: Length from 13.5 mm. in case of small males, to 15.5 mm. in case of the females, much larger therefore than the other two species described from the United States.

Color: General fascies dark, color and pattern variable, dorsum lighter than venter; in the fully winged forms the wings are usually light brown with darker brown veins, sometimes they are grayish; head and thorax brown above; the abdomen in brachypterous forms usually dark above as well as beneath, the sides of the abdomen usually marked by a more or less definite lighter line in which are situated five or six white or pale spots.

Structural characteristics: The relative lengths of the three body regions are as follows: For the ♀ head: thorax: abdomen:: 4: 4.5: 6+; for the ♂ head: thorax: abdomen :: 4: 4.25: 5.5; the antennæ in both sexes average 7 mm. in length with the ratio for the four segments as follows: 1st: 2nd: 3d: 4th: : : 22: 32: 90: 48. The ratio of the postocular portion of head to the anteocular portion is approximately as 3: 5, the tip of the rostrum extends behind the eyes to a point near the middle of the postocular portion of the head; the distal end of the fore femur in most specimens attaining or surpassing the base of the antenna, the distal end of the hind femur in both sexes usually reaching to caudal end of sixth abdominal segment, and in the males, often to tip of abdomen. The antennæ are approximately half the length of the body, the first segment is slender at base but much thicker in its outer part and extends beyond the head two-thirds of its length, the second and succeeding segments slender; the tylus is rounded as viewed from above, the anterior portion of the head is swollen as with the other species; between the eyes above and beneath are distinct depressions, the postocular portion of the head distinctly thicker than the section before the eyes; the thorax is irregularly marked with whitish pits and there is an impressed longitudinal line of these pits on pronotum, another post-marginal row about the anterior margin of the prothorax and numerous irregularly placed pits on the sides above the coxae. The species varies from fully winged forms through all stages to entirely apterous individuals; the sixth segment of the female is thickened, the dorsum more elevated than in the other species; the last dorsal plate is short and depressed across the middle; the sixth segment of the male has a pair of short, widely separated elevations on its ventral side; the seventh segment is slightly swollen about its middle as seen from above. See figures 1, 6, 9, 10 and 11.

Notes:

This large and distinctive species is about the size of the one Champion describes under the name *Hydrometra caraiba* Guer. It differs from this in the rostrum being longer, the antennæ shorter with segments of different relative lengths and the anteocular portion of the head relatively shorter. Neither does it agree with any other species described from the Americas. Besides being considerably larger than our previously described United States species, the appendages are more elongate, the first segment of antennæ extends beyond the head two-thirds of its length while in our other two species it projects only about one-half its length, the tylus is broadly rounded as viewed from above while it is bluntly pointed in our others. The following table will serve to separate the three species now recognized from the United States:

KEY TO HYDROMETRA IN AMERICA NORTH OF MEXICO.

A. Pits above middle coxa numerous and irregularly placed, length more than 13 mm. (13½—15½ mm.) (See Fig. 1) ..... *H. wileyi* sp. nov.

AA. Pits on side above middle coxa seldom more than four, length less than 12 mm. (8—11 mm) (See Figs. 2 and 3).

B. Pits on side above middle coxa normally two, terminal segment of male abruptly swollen toward tip as seen from above, under side of the sixth segment in male with two thin, plate-like elevations .... *H. martini* Kirk.

BB. Pits on side above middle coxa normally four, terminal segment of male not abruptly swollen toward tip as seen from above, under side of sixth segment in male with two conical elevations ..... *H. australis* Say.

The description of the new species, *H. wileyi*, was drawn from a study of a series of 362 specimens collected by Mrs. Grace Wiley, near Rock Island, Colorado County, Texas. The holotype, allotype and paratypes are in the University of Kansas collection. Paratypes have been sent also to U. S. N. M., Carnegie Museum, Canadian National Collection, Ottawa, Canada, Cornell University, University of Minnesota, and the following private collections: Mrs. Grace Wiley, Mr. J. R. de la Torre Bueno, Dr. H. M. Parshley, Professor H. G. Barber, R. F. Hussey, Dr. Carl Drake, W. E. Hoffmann and my own collection.

EXPLANATION OF PLATE

Fig. 1. Side view of head, pro- and mesothorax of *Hydrometra wileyi* sp. nov.
2. Side view of head, pro- and mesothorax of *Hydrometra martini* Kirk.
3. Side view of head, pro- and mesothorax of *Hydrometra australis* Say.
4. Dorsal view of terminal abdominal segments of male of *Hydrometra australis* Say.
5. Dorsal view of terminal abdominal segments of male of *Hydrometra martini* Kirk.
6. Dorsal view of terminal abdominal segments of male of *Hydrometra wileyi* sp. nov.
7. Ventral view of terminal abdominal segments of male of *Hydrometra australis* Say.
8. Ventral view of terminal abdominal segments of male of *Hydrometra martini* Kirk.
9. Ventral view of terminal abdominal segments of male of *Hydrometra wileyi* sp. nov.
10. Side view of terminal abdominal segments of male of *Hydrometra wileyi* sp. nov.
11. Side view of terminal abdominal segments of female of *Hydrometra wileyi* sp. nov.
12. Side view of terminal abdominal segments of male of *Hydrometra martini* Kirk.
13. Side view of terminal abdominal segments of female of *Hydrometra martini* Kirk.
14. Side view of terminal abdominal segments of male of *Hydrometra australis* Say.
15. Side view of terminal abdominal segments of female of *Hydrometra australis* Say.

THE STENOSYRPHUS SODALIS GROUP (SYRPHIDAE, DIPTERA)*

BY C. HOWARD CURRAN,

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The genus *Stenosyrphus* Mats. is distinguished from *Syrphus,* in which all the North American species have previously been included, by the sides of the abdomen curving under and not being margined. The eyes of the *sodalis* group are hairy, face usually without a median black stripe, but in one species with one, or sometimes wholly black; cheeks and oral margin black; abdomen oval or elliptical, with three interrupted bands, the resultant spots slightly concave in front, convex behind; all the femora black basally in both sexes. The four closely related species may be distinguished as follows:

1. Face with a median black stripe, sometimes (in the ♂) wholly black . . . . *nigrifacies* n. sp.
   Face not with a median black stripe, rarely slightly brownish 2
2. The first pair of spots do not attain the lateral margin; or legs not as in *sodalis* 3
   The first pair of spots reach the lateral margin; hind femora of both sexes black on at least the basal three-fourths; second pair of abdominal spots in ♂, wider than the following black band ..... *sodalis* Will.
3. Hind femora black on not more than the basal third; front of female not nearly as wide at antennæ as length from vertex to antennæ *contumax* O.S.
   Hind femora black on basal four-fifths; front of female as wide at antennae as long .....*interruptus* Mall.

Stenosyrphus sodalis Williston.

Synopsis N. Am. Syrph., p. 74.

Length 9—10 mm. *Male.* Face reddish or brownish yellow, thinly whitish pollinose, in profile very slightly receding, the tubercle large, sub-nose shaped, between the tubercle and antennae rather deeply concave, below the tubercle shortly and conspicuously concave to the prominent anterior oral tip; very slightly produced downwards. Cheeks and oral margin to the lower level of the tubercle, black; frontal triangle black, but obscured in certain lights, except just above the antennae, by greyish pollen; the yellow ground in which the antennae are inserted extends just onto the arms of the W. Vertical triangle rather dull black. Occiput next to the eyes grey pruinose. Pile on face, front and vertical triangle moderately long, black; on the middle of the face, occiput eyes and cheeks, yellowish. Antennae black, third joint reddish below, basally. Arista black.

Thorax metallic blackish blue, the disc more or less dull. Pile rather pale yellow, yellow on the margins of the dorsum; sometimes a few conspicuous black hairs on the upper end of the mesopleura. Scutellum translucent yellowish, the corners bluish black, sometimes a distinct metallic bluish reflection; pile black, not very abundant.

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*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept., of Agric., Ottawa.

Femora black, the apical third to one-fourth of the front four and fifth of the hind ones, reddish yellow. Tibiae reddish yellow, the hind ones with a conspicuous black band occupying about the sub-apical half; the front four sometimes with distinct but narrower bands on apical half; tarsi all black or brown. Pile on the legs mostly yellow, but the long hairs behind the front four are black except basally. Front and hind foot cushions brassy yellow.

Wings hyaline or slightly brownish; stigma luteous or brownish. The costa ends just before the tip of the wing; the third vein is curved a little forward beyond the middle of the first posterior cell. Squamae translucent whitish, with almost white fringe, the border yellowish. Halteres yellow.

Abdomen opaque black, the lateral margins wholly, apex of the fourth and whole of the fifth segments shining; adorned with three pairs of yellow spots. First pair of spots broadly interrupted, sub-triangular (sometimes scarcely sub-triangular), their inner ends rounded, their anterior outer ends produced rather broadly to reach the margin at the anterior third. Second and third pair of spots narrowly interrupted, slightly concave in front, convex behind, their posterior corners rounded off, narrowly and distinctly separated from the lateral margin, but approaching it in front, or sometimes quite reaching the margin in front; the spots are narrowly separated from the anterior margin of the segment and are of greater width than the following black band; posterior margin of the fourth segment, large anterior angles of the fifth and the narrow apex of the fifth yellow. Pile black; before the first yellow spots, on all the yellow spots and on the side margins opposite them, yellow. Venter yellow; second and third segments with obscure, dark, rather large subtriangular median areas.

Female. Face reddish yellow; in profile less concave above, the tubercle longer, nose-shaped. Front shining greenish or bronze black, across the middle the colour obscured by greyish yellow to tawny pollen, leaving a shining arch above the antennae; just above the antennae a narrow arch of yellow. Pile of front all black but it may be paler laterally opposite the pollinose band; pile of face almost all pale; occipital pile almost white.

The thorax may be metallic blackish blue or more greenish black, and there is never any black hair on the pleura. Less black hair on the femora.

Abdominal spots narrower and less widely separated; the first pair of spots transverse, their inner ends rounded. On the fifth segment the basal spots are transverse and narrowly separated but not as wide as those on the fourth, sometimes they may be almost as in the male.

In other respects similar to the male.

Description from 12 specimens from Colorado, British Columbia, Alberta and Alaska. In addition I have examined specimens from New Mexico, Washington, Oregon and Idaho which agree perfectly, according to comparison.

This species was originally described from Colorado. It is distinguished from its allies by the first spots extending over the lateral margin, and the wider abdominal bands. In addition, it is distinguished from *nigrifacies* by lacking a median facial stripe; from *contumax* by having the hind femora black on the basal four fifths in the female and the wholly yellow pilose thoracic dorsum in

the male; from *interruptus*, of which only the female is known, by the much narrower front, and yellow pilose hind coxae.

Stenosyrphus interruptus Malloch.

Syrphus sodalis var. *interruptus* Malloch, Rep. Can. Arct. Exped., 55C.

Malloch described this species as a variety of *sodalis* but was not at all sure of its identity, as he labelled one specimen as the variety with a query and included a third specimen under *sodalis*. There can be no confusion between the two species as the front is abnormally wide. None of the specimens are in good condition. I give the following description from these specimens, but it may not entirely agree with perfect ones. The male should be distinguished by having black pile on the hind coxae in addition to the other characters.

Length, 8 to 9 mm. *Female*. Face shining reddish, with a deep bluish reflection in some lights; perpendicular, the tubercle nose shaped, large and prominent; not or scarcely concave above it, shortly and shallowly concave below, the anterior oral margin just a little prominent; scarcely any trace of swelling just below the insertion of the antennae. Front shining black with strong brassy or bronze reflections; especially narrowly brassy across the middle, where there may be a light band of whitish, greyish or yellowish pollen. Width of front at antenna approximately 3 mm., at vertex 1.2 mm., length from base of antennae to vertex (not considering the convexity), 1.75 mm. (The same ratio is true of the two other specimens). Cheeks shining black. Face and front black pilose; occiput with yellow and black intermixed. Antennae black.

Thorax greenish black? the disc more or less opaque. Pile tawny or yellowish; conspicuous black hairs on the upper half of the mesopleura. Scutellum translucent yellow, its corners black; pile black.

Femora black; the apical third of the four front and fifth of the hind ones, reddish; tibiae reddish, the hind ones with a rather narrow brownish band near the middle; tarsi all brownish or black. Pile of legs pallid, yellowish; most of the long hairs on the femora black, but those on the basal area pale; sometimes about half pale on the hind ones.

Wings hyaline, stigma luteous; third vein joining the costa just before the tip of the wing. Squamae whitish with yellow border and fringe. Halteres reddish, sometimes a little infuscated.

Abdomen sub-opaque black, the side margins wholly, apices of the third and fourth segments and the fifth entirely, shining; with three pairs of transverse, rather narrow reddish yellow spots, the first pair broadly separated from each other and slightly less broadly so from the lateral margins, the third pair may or may not reach the margins, but the second pair appears to be distinctly separated. There appears to be an inclination for the spots to be much smaller and less distinct than in the type, in which specimen they are shaped as in *sodalis*, but are only about half the width, therefore occupying only about one-fourth the length of the segment. Narrow apices of the fourth and fifth segments and small anterior angles of the latter reddish. Pile black; in front of

the first pair of spots and on the yellow bands and margins opposite, yellow. Colour of venter indeterminate.

Described from three females from Alaska, including the type.

This species is very distinct from its allies and may be at once recognized by the broad front and black haired hind coxae. In the male the hind legs are probably all black except just the knees and abdominal bands are probably narrower than in the other species.

Stenosyrphus nigrifacies new species.

Length 8 to 9 mm. *Male.* Face and front shining black; except a median line which extends just over the tubercle, the oral margin and an arch above the antennae, moderately yellowish or greyish yellow pollinose; sides of face above sometimes yellow on about one fourth the width; in the type wholly black. Face slightly receding in profile, the tubercle nose shaped and not very prominent, moderately concave above the tubercle, a little swollen just below the antennae, below the tubercle moderately long, shallowly concave, the anterior oral tip somewhat produced. Pile of face and frontal triangle black. Frontal triangle with more or less brassy reflection; vertical triangle rather dull black; with black pile. Occiput greyish pollinose, it and the cheeks yellow pilose. Eyes with short pallid pile. Antennae inserted on yellow ground, black; arista black, thickened on basal half.

Thorax metallic greenish or bluish black, the dorsum rather olivaceous. Pile black, possibly a few pale hairs intermixed between the humeri; lower half of pleura always and postalar calli sometimes, with yellow pile. Scutellum transluscent yellowish or reddish yellow, with long black pile.

Legs black; narrow apices of the femora, bases of all the tibiae, the hind ones narrowly so, and apex of the front ones, reddish or yellowish. Pile of legs black, except on the front tibiae, hind coxae and the bases of the femora. Pubescence inside the front tibiae and beneath their tarsi, yellow, inside the hind tibiae and beneath their tarsi, tawny.

Wings brownish yellowish, fading out posteriorly; stigma brownish. Third vein ends in the tip of the wing. Squamae whitish with yellow border and fringe. Halteres yellow.

Abdomen subopaque black, the margins shining; with three pairs of transverse yellow spots. First pair of spots about the middle of the second segment, somewhat oblique as their outer end reaches forward, but is broadly separated from the lateral margin; in shape, sub-oval or sub-triangular-oval. Second and third pair of spots narrowly separated medianly, attenuated laterally, but reaching the margin in one-fourth to one-half the width of the spots, their anterior margin slightly concave, the posterior convex, the inner end rounded off behind, although on the third pair less so; fourth segment with a conspicuous yellow hind margin, the fifth with triangles, sometimes transverse and moderately separated, on the anterior angles, the hind margin of the segment not yellow. Pile moderately long, black; rather tawny or yellow before the basal spots; on the spots and just where they reach the margins, yellowish.

Venter with the membranes and sutures greyish yellow or somewhat hoary; each sternite has a yellow basal triangle on either side.

Female. The reddish yellow colour occupies slightly more than one third the width of the face on either side; the shining black middle stripe reaches up between the antennae, but is more brownish above. Face less concave above, the tubercle rather more robust but not quite so prominent. Pile of face and front all black. Front shining bronze black; on the sides below, extending less densely across the middle, tawny pollinose. The front is slightly longer than its width at the antennae, but appears much longer as the sides are sub-parallel above. Third antennal joint reddish below.

Thorax aeneous or brassy black, with wholly pale pile. Scutellum with yellow pile basally, black apically.

Front and middle tibiae brownish, their bases broadly and their apices yellow. Pile as in the male, but more extensively pale on the posterior four femora. Wings paler.

Abdomen more shining; first pair of spots longer, reaching the lateral margin moderately broadly just behind the anterior angles. (This character is probably somewhat variable). The remaining bands are slightly narrower than in the ♂ and more narrowed laterally, but they expand just on the lateral margin. The pile is shorter throughout. Otherwise as in the ♂.

Holotype, ♂, Banff, Albert, July 14, 1922 (C. B. D. Garrett); No. 518. in the Canadian National Collection, Ottawa.

Allotype, ♀, Banff, Alta., July 15, 1922 (C. B. D. Garrett).

Paratype, ♂, Banff, July 13, 1922 (C. B. D. Garrett).

This species is readily distinguished in both sexes by the dark face and cannot therefore be confused.

Stenosyrphus contumax Osten Sacken.

Osten Sacken, Proc. Bost. Soc. Nat. Hist., 1875, P. 147.

Length 8.5 mm. to 9.5 mm. *Male.* Face reddish yellowish, a stripe running over the tubercle slightly brownish; cheeks, oral margin as high as the lower edge of the tubercle, and the frontal triangle, shining black. Face in profile moderately long concave above, a moderately large swelling just below the antennae, tubercle prominent, sub-nose-shaped, below the tubercle shortly, shallowly concave, the oral tip a little produced; face very little receding. Frontal triangle thickly clothed with yellowish pollen, an arch above the antennae shining; the W mostly reddish, with a conspicuous red spot on the median arms. Pile of face, frontal and vertical triangles black, moderately long. Vertical triangle subshining black. Occiput yellowish grey pollinose, with yellow pile, cheeks yellowish pilose; occipital ciliae black. Antenna situated in yellow ground; black; third joint reddish below at the base; arista rather slender. Eyes with fine pale yellowish pile.

Thorax greenish black, the disc somewhat darkened. Pile rather tawny; on the dorsum inside the lateral margins usually with a longitudinal stripe of black hairs; these extend down before the suture and onto the upper posterior corner of the mesopleura; there are also a few scattered black hairs between

the humeri. Scutellum steel blue with just an indication of translucent yellowish; its pile black.

Legs black; apical fifth of femora, basal half of front four tibiae and fourth of the hind ones, reddish; front four tibiae brownish on apical half. Pile yellowish; the long hairs on the femora, except on the basal half of the hind ones, black; hind tibiae with black hairs. Inner side of the front tibiae, inner apical fourth of the hind ones, and the front and hind tarsi beneath, tawny pubescent.

Wings somewhat luteous; stigma brown. Third vein ends just before the tip of the wing. Squamae whitish with a slight brownish tinge, with yellow border and fringe. Halteres yellow.

Abdomen opaque black; the side margins, apices of third and fourth and whole of the fifth segments, shining; with three pairs of transverse yellow spots, the first pair broadly, the other two pairs narrowly separated in the middle. First pair of spots near the middle of the second segment, a little oblique as they reach forward laterally, but are broadly separated from the lateral margin; inner ends rounded, front margin irregularly straight; hind margin convex. Second pair of spots widest sublaterally; anterior margin slightly concave, the posterior convex; inner end rounded; outer end cut off obliquely. Third pair of spots similar, but narrower and of more equal width. Apices of fourth and fifth segments, and anterior angles of the latter, reddish. None of the spots reach the side margins. Pile black; before the first pair of spots, on the yellow bands and opposite them, yellow. Venter yellow, each segment with a posterior fuscous crossband reaching forward in the middle to the anterior margin; that on the second segment obsolete laterally, so that only a fuscous triangle is left.

Female. Face more deeply concave above, the tubercle rather sharper. Front shining black, with bronze or brassy reflections except at the vertex and just above the antennae. On almost the lower half with a grey or yellowish pollinose crossband; gradually narrowing from the antennae to the vertex. Pile of face and front black.

Thorax often decidedly brassy, the dorsum with four or five narrow, longitudinal bronze or purplish stripes. Pile all yellow. Scutellum translucent yellow, with black pile.

Legs reddish; basal third of the femora and all the tarsi, black.

Wings hyaline or slightly luteous. Stigma luteous.

Abdomen sub-shining. First pair of spots longer, less widely separated. Normally none of the bands reach the margin, but all or the last two pairs may sometimes do so. Ventral spots small, usually restricted to median triangles. Otherwise as in the ♂.

Description from eleven specimens of both sexes from Labrador, Alberta and Colorado.

The specimens before me agree well with Osten Sacken's description, but the pile on the thorax is evidently paler in colour.

NEW WESTERN SPECIES OF DOLERUS (TENTHREDINIDAE HYMENOPTERA)*

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The species of Dolerus of the eastern United States and Canada are well known, most of the species have been studied and described. The following descriptions are a first instalment of a number of western species that have been in course of study for some time. All the species here described were received from Professor A. L. Lovett of the Oregon State Agricultural College.

Dolerus napaeus n. sp.

Female. Body black, densely covered with long white setae; the antennae with the first segment of the flagellum slightly longer than the second; median fovea not well defined; the head ventrad of the ocelli closely punctured, the vertical orbits polished, the postocellar area sparsely punctured; the vertical furrows deep, broad, longer than wide; the dorsal aspect of the thorax uniformly closely punctured; the median lobe of the mesonotum without a row of large punctures; mesopleura coarsely punctured; the pectus without rows of punctures; the saw-guides with the dorsal margin convex, the ventral margin oblique, the distal portion convexly oblique, the apex above, short, truncately rounded; the wings hyaline, the veins and the stigma brown. Length, 10 mm.

Habitat. Corvallis, Oregon; G. F. Mozette and Johnson, collectors. This species is related to the *apriloides* group.

Dolerus narratus n. sp.

Female. Body wholly black except a fine pale line on the caudal margin of the abdominal segments; the antennae with the first segment of the flagellum longer than the second; the head coarsely punctured, the vertical furrows elongate, punctiform depressions; the postocellar area more finely and densely punctured than the remainder of the head, the vertical orbits without ridges or depressions, but punctured; tops of the convexities of the lobes of the mesonotum smooth, polished; the mesoscutellum finely, densely punctured, no more densely punctured than the adjacent parts of the lateral lobes, but distinctly more densely punctured than the median lobe; the pectus not with rows of large punctures; the saw-guides with the ventral margin oblique, the distal end obliquely truncate, the apex above with long setae; the wings hyaline, the veins and the stigma brownish. Length, 9 mm.

Male. The male is idenetical in color and structure with the female.

Habitat. Mary's Peak, Corvallis, Oregon; collected by Lovett, Middlekauff, Crosby, Zwicker, and Ballard. The punctured vertical orbits of this species will separate it from *napaeus* MacG.

Dolerus nasutus n. sp.

Female. Body wholly black; the antennae with the first segment of the flagellum longer than the second; the head coarsely punctured, the front and

*—Contributions from the Entomological Laboratories of the University of Illinois, No. 73.

frontal orbits finely and closely; the vertical furrows elongate and punctiform depressions; the postocellar area not more finely punctured than the front, the punctures of the vertical orbits large, with a tendency to form rugosities; a deep, concave furrow extending from the vertical furrows to the compound eyes; median lobe of the mesonotum uniformly punctured, without an impunctate area; lobes of the mesonotum uniformly finely punctured, not so closely punctured as the mesoscutellum; the saw-guides convex on the dorsal margin and on the ventral margin, obliquely convexly rounded to a blunt point above, distal portion with long setae; the wings hyaline, the veins and stigma black. Length 10 mm.

Male. This sex appears to differ only in having the transverse furrow extending from the vertical furrows to the compound eyes not so broad or so deep. Length 9 mm.

Habitat. Corvallis, Oregon, Laura Hill, collector and Renton, Washington, H. F. Wilson, collector. This species is near *inspiratus* MacG.

Dolerus nefastus n. sp.

Female. Body black with the prothorax, the tegulae, the median lobe of the mesonotum, the caudal half of each lateral lobe, sometimes extending along the sides so that each lobe appears to bear a discal black spot, sometimes with all of lateral lobes pale, and abdominal segments one to four, rufous; the antennae with the first segment of the flagellum distinctly longer than the second, the second and third subequal; the head punctate, the ocellar area and the frontal orbits finely densely punctate, the remainder of the head coarsely punctate, the punctation of the postocellar area and of the vertical orbits similar in size, a transverse furrow extending from the vertical furrows to the compound eyes; the mesonotum uniformly punctured, the mesopleura densely punctured; the striations of the scutellar appendage distinct; the saw guides with the dorsal and ventral margins parallel, the distal end obliquely truncate and bearing numerous long setae; the wings hyaline, the veins and the stigma black. Length, 9 mm.

Habitat. Corvallis, Oregon; Laura Hill, collector. This species is related to *inspiratus* MacG. and *nefastus* MacG.

Dolerus nugatorius n. sp.

Female. Body entirely black, densely covered with long white setae, giving a hoary appearance to many parts; the antennae with the first segment of the flagellum slightly longer than the second, the second longer than the third; the front and frontal orbits finely densely punctured; the vertical orbits densely coarsely punctured; indication of a ridge extending from each vertical orbit toward a compound eye, head depressed in front of this ridge, but not forming a furrow; the postocellar area coarsely punctured; the median lobe of the mesonotum densely punctured, those along each lateral margin much larger; the lateral lobes of the mesonotum and the mesoscutellum finely sparsely punctate; the mesopleura coarsely punctate; the appendage of the scutellum coarsely transversely striate; the saw-guides with the dorsal and ventral margins straight, the

distal end oblique, convexly rounded, bluntly pointed at apex above; the wings hyaline, the veins and stigma black. Length, 9 mm.

Male. The male is not strongly punctate and the ridge on the head is almost wanting. Length, 9 mm.

Habitat. Pee Dee, Oregon, Vincent, collector; Mary's Peak, Corvallis, Oregon, A. L. Lovett, collector. The black color and the structure of the head and thorax will differentiate this species.

Dolerus numerosus n. sp.

Female. Body black with a fine white line along the caudal margin of the abdominal segments pale; the antennae with the first segment of the flagellum distinctly longer than the second, the second and third subequal; the front and the frontal orbits finely densely punctate, the postocellar area finely punctate, the vertical orbits coarsely punctate; head without a furrow from the vertical furrows extending toward the compound eyes; the vertical furrows linear, almost wanting; the lobes of the mesonotum uniformly finely punctured, none of the punctations coarser than others; the mesoscutellum finely densely punctate; the mesopleura coarsely punctate; the saw-guides with the dorsal and ventral margins converging, the ventral margin convex, the apex pointed; the wings hyaline, the veins and the stigma black. Length, 10 mm.

Male. A male collected in the same month and bearing the same number is undoubtedly the male of this species. It has a broad furrow limited to the caudal margin of the compound eyes. Length, 9 mm.

Habitat. Corvallis, Oregon; H. S. Walters, collector. The punctation of the front, postocellar area, and the vertical orbits will separate this species from the preceding.

Dolerus novellus n. sp.

Female. Body black with a very fine white line along the caudal margin of the abdominal segments; the antennae with the first segment of the flagellum much longer than the second, the second and third subequal; the front and frontal orbits finely densely punctate, the postocellar area finely punctate, the vertical orbits coarsely punctate; a deep furrow extending from the vertical furrows behind the compound eyes; the vertical furrows elongate deep pits with flaring sides; the median lobe of the mesonotum uniformly densely punctate, not with larger punctures along each side; the lateral lobes of the mesonotum and the mesoscutellum finely punctured; the mesopleura densely punctured; the saw-guides with the dorsal margin oblique, the ventral margin broadly convexly rounded to a sharp point above at apex; the wings hyaline, the veins and stigma black. Length, 10 mm.

Habitat. Mary's Peak, Corvallis, Oregon; received from A. L. Lovett, Hardman collector. This species runs to *abdominalis* Norton, from which it is easily separated by the black color.

Dolerus novicius n. sp.

Female. Body black with the prothorax, the tegulae, the median and the

lateral lobes of the mesonotum, the apices of the profemora and mesofemora, the tibiae, the distal two-thirds of the metatibiae, the tarsi infuscated, and abdominal segments one to five and part of the sixth, rufous; the antennae with the first segment of the flagellum longer than the second, the second and the third subequal; the front and the frontal orbits finely densely punctured, the remainder of the head finely more sparsely punctate; a rounded furrow extending from the linear vertical orbits behind the compound eyes, the bottom of the furrows polished and sparsely punctate; the lobes of the mesonotum more sparsely punctate, the mesoscutellum finely densely punctate; the mesopleura coarsely punctate; the saw-guides with the dorsal and ventral margins straight, the distal end obliquely truncated, slightly convex, densely setiferous; wings hyaline, the veins and the greater part of the stigma black, the caudal margin pale. Length, 8 mm.

Habitat. Hood's River, Oregon, Childs Collector. This species is related to *aprilis* Norton.

Dolerus nicaeus n. sp.

Female. Body entirely black, the head and thorax hoary in spots with long white setae; the antennae with the first segment of the flagellum nearly as long as the subequal second and third together; the front and frontal orbits finely densely punctate; the vertical orbits sparsely punctate, the punctures large; the vertical furrows punctiform; the head with a broad transverse furrow extending from the vertical furrows behind the compound eyes; medium lobe of mesonotum closely punctate, not with a row of large punctures on each side; each lateral lobe uniformly punctate, not so densely as the median lobe; the mesoscutellum finely punctate; the mesopleura finely closely punctate; the pectus almost polished; the saw-guides with the dorsal margin straight, the ventral margin short and straight, the distal portion elongate, oblique, bluntly pointed above, setiferous; the wings slightly smoky, veins and stigma black. Length, 11 mm.

Habitat. Chilliwack, British Columbia; received from A. L. Lovett. This species is related to *nasutus* MacG.

Dolerus nepotulus n. sp.

Male. Body entirely black, the head and thorax hoary with long white setae; the antennae with the first segment of the flagellum subequal in length to the second which is subequal to the third; the front and frontal orbits finely densely punctate; the postocellar area obscurely punctate, the vertical orbits broadly polished; the vertical furrows slit-like; the head not with a transverse furrow extending from the vertical furrows behind the compound eyes; the mesonotum with the median lobe uniformly punctate, not with a row of large punctures on each side; the lateral lobes of the mesonotum and the mesoscutellum finely punctate; the mesopleura coarsely sparsely punctate; the wings hyaline, the veins and the stigma black. Length, 7 mm.

Habitat. Linn County, Oregon; received from A. L. Lovett. This species is related to *nudus* MacG.

ON THE ECOLOGY OF PODOPS CINCTIPES SAY AND RHYTIDOLOMIA SAUCIA SAY, (HEMIPTERA, PENTATOMIDAE).*

BY H. M. PARSHLEY,

Northampton, Mass.

One of the exercises done by the class in field zoology at the Biological Laboratory, Cold Spring Harbor, Long Island, N.Y., is a detailed study of the animals of the "Jones Marsh," a small salt meadow, which is partially overflowed by seawater at times of high tide, and hence supports a special fauna and flora. Among the characteristic plants are *Spartina patens* (Ait.) Muhl., which forms a broad zone just behind the high water line, and *Juncus gerardi* Lois., marking the next zone away from the shore. With these plants, as we found during the past summer (July 27-28) are intimately associated the Pentatomids *Podops cinctipes* Say and *Rhytidolomia saucia* Say, insects whose habits are little known, although they are common in collections.

In habit of growth the two plants mentioned are somewhat similar—they form a thick- tangled thatch like coarse hair, which affords ideal shelter to various salt-marsh animals and renders ordinary collecting methods futile. If, however, the collector discards his net, and, kneeling, parts the thick mat of vegetation, he will find Podops and Rhytidolomia at home (on their respective plants), clambering about among the closely set stems from which they draw sustenance.

Podops cinctipes Say.

This is a small, dark brown species, one of our few representatives of the subfamily Graphosomatinae (notable for the large scutellum), which is of wide distribution in the United States and Canada. Evidently it is not confined to salt marshes, and hence it is clear that *Juncus gerardi* is not its sole food-plant—doubtless other species of rushes will serve as well. Among the few published notes on the habits of *P. cinctipes* are statements that it has been found in "marshes," "meadows," "wet situations," and I have taken it under stones near salt water and in sweeping marsh plants. During the past summer, I found the nymphs in large numbers among the stems of *Juncus gerardi,* and, wishing to obtain adults for determination, I dug up a small tuft of the plant with its roots, placed it simply in a pint jar with nymphs of various sizes, and thus transferred a bit of the marsh to Northampton. This crude method proved successful: the mature insects appeared in due time, mated, and one laid a dozen eggs in a double row on a Juncus stem. The eggs hatched in about six days, but it was necessary to kill and preserve the young, as by this time the food-plant had withered, succumbing finally to two or three weeks' separation from its native soil.

The egg (fig. 2) is yellowish white, 1 mm. in length, cylindrical, rounded at bottom, and provided with a shallow lid. The surface is minutely reticulated and around the upper end is a series of about 26 very small chorial processes, which (at least after hatching) lie so closely against the surface that even under high magnification they appear merely as tiny white markings. The anchor-shaped egg-burster in a remnant of membrane is to be seen at the opening of each egg shell.

*—Contributions from the Department of Zoology, Smith College, No. 99.

The first stage nymph is about one mm. in length shortly after hatching, and is almost hemispherical in shape. The surface bears coarse, remote, dark punctures; the head, fourth antennal segment, thorax, area of the abdominal glands, marginal spots of abdomen, tarsi, and apices of femora are dark grayish brown, with bronzed lustre; the rest yellow. The head is a little broader than long, smoothly convex, the eyes scarcely projecting; the antennae are very short, the first three segments hardly longer than broad, the fourth about as long as the others together.

1 2

Podops cinctipes Say:—1, nymph of the fifth instar (x 15), 2, the egg after hatching (x 50).

Several later stages, collected in the field, presented a uniform and characteristic general appearance: in form they all agree rather closely with the fifth (fig. 1), being much less convex than the first. The general coloration is dark grayish brown, with bronzed lustre; on the pronotum are two small, yellow spots and the dark calli; at the basal angles of the scutellar region are two similar spots, flanked by small black areas, and the front wing-pads are more or less infuscated; the scent-gland areas and abdominal margin are distinctly patterned in black. The ground color of head, thorax, and abdomen is pale yellow, but the black punctures are so coarse and numerous as to produce a general dark effect.

In an intermediate stage (the third?) the eyes are distinctly prominent, the pronotum is but slightly shorter than the scutellum on the median line, the wing-pads are slightly developed, not reaching the level of the apex of scutellum, and the antennae are very stout, intermediate in this respect between those of the first and fifth instars.

The fifth stage nymph (fig. 1) is 5—6 mm. in length, and the form is but slightly convex, the abdomen being flat laterally. As in the older nymphs of *Nezara viridula* Linn.,[1] there appear to be light and dark forms, the former due to brown instead of black punctation, but in living specimens the difference is not striking and intermediates occur.

Studying this species in the light of Hart's keys[2] for Pentatomid nymphs, I find that abdominal spiracles 2—6 are accompanied each by but *one* setigerous puncture (trichobothrium of Tullgren), which is very distinctly developed.

1—Jones, T. H., The Southern Green Plant-bug, U. S. Dept. Agri., Bull. 689, 1918.
2—Pent. of Illinois, Bull. Ill. Nat. Hist. Surv., XIII, 1919.

whereas the other Pentatomidae have regularly *two*. This character, then, may be temporarily employed in interpolating the Graphosomatinae in Hart's key. I hope shortly to have some further information (drawn from European material) on the validity of this nymphal subfamily character.

Rhytidolomia saucia Say.

This beautiful insect is one of the most striking and characteristic inhabitants of the "*Spartina patens* zone." Adults and nymphs occur in great abundance among the densely matted stems of the plant, where their presence would be quite unsuspected without special scrutiny. This species has been found only along the Atlantic coast, from Massachusetts to Florida, and I believe that it is confined to salt marshes, possibly to *Spartina patens*, as its sole food plant, since this grass occurs within the same limits.

The nymph (late stage) of *R. saucia* is easily recognized by its striking color pattern. The ground color is bright yellow, the surface provided with black and brown punctures and dots so small and sparse that they hardly affect the general light shade. The third antennal segment, except at base, and the fourth, are black, as are the eyes. The head and thorax bear four broad black stripes, the median pair, separated by a narrow mid-dorsal pale line, beginning faintly on the head and gradually broadening to the apex of the scutellum, the lateral beginning at the anterior margin of the pronotum just behind the eyes and similarly widening to the apices of the wing-pads. The scent-gland areas are black, and the dorsal surface of the abdomen, except for a narrow, pale margin, is dusky yellow, crossed by numerous narrow and nebulous streaks of dark brown. In form this nymph is somewhat more elongate than *P. cintipes* (fig. 1), the head much larger in proportion and the scutellum much shorter. Specimens at hand measure 7—8 mm. in length.

In Hart's key the nymph of *R. saucia* runs to *Chlorochroa*, if we consider the scarcely impressed dotting of the abdominal tergum to be marks, not punctures; here it is readily distinguished by its bold color pattern, described above, and its elongate form.

ANNOTATED CHECK LIST OF THE MACROLEPIDOPTERA OF ALBERTA—ADDITIONS, 1921.

BY KENNETH BOWMAN,

Edmonton, Alta.

The following are additions during 1921 to the "Check List of the Macrolepidoptera of Alberta," published by the Alberta Natural History Society, Red Deer, Alberta, in 1919.

The identifications were made by Dr. Barnes, Dr. J. McDunnough, Messrs. Cassino and Swett, to whom I am much indebted for their kindness. The numbers refer to the month of capture, the letters are the abbreviations for the locality as given in the Check List.

65 *Eurymus alexandra* Edw. ..... 7 N
129 *Oeneis taygete* Hbn. ..... 7 N.
219 *Euphydryas anicia capella* Barnes ..... 6 Bm
306 *Basilarchia lorquini burrisoni* Mayn. ..... 6 Bm
432 *Plebeius yukona* Holl. ..... 7 F.

437 *Plebeius lupini* Bdv. ..... 6 Bm.
449 *Glaucopsyche lygdamus columbia* Skin. ..... 6 Bm.
N.S. *Neoarctia sordida* McD. ..... 6 B.
1218 *Copablepharon alba* Harv. ..... Lb.
1259 *Euxoa catenula* Grt. ..... Lb.
1273 *Euxoa intrita strigilis* Grt. ..... 8 E.
1274 *Euxoa rufula basiflava* Sm. ..... 8 L.
1359 *Euxoa westermani* Staud. ..... 7 N.
N.S. *Anomogyna partita* McD. ..... 7—8 C. L. P. N. E.
N.S. *Anomogyna homogena* McD. ..... 7—9 B. P. N.
1516 *Apharetra dentata* Grt. ..... 7 N.
1548 *Mythimna olivata* Harv. ..... 8 L.
1652 *Lasionycta subfuscula* Grt. ..... 6 Bm.
2022 *Oncocnèmis albifasciata* Hamp. ..... Lb.
2043 *Graptolitha tepida atincta* Sm. ..... 4 E.
2588 *Platyperigia anotha* Dyar ..... 8 L.
2596 *Crambodes talidiformis* Gn. ..... Lb.
2613 *Menopsimus caducus* Dyar. ..... 7 N. E.
2790 *Bellura diffusa* Grt. ..... 6 E.
3012 *Sarrothripus revayana lintneriana* Spey. ..... 9 E.
3057 *Catocala verecunda* Hlst. ..... Lb.
3227 *Autographa diasema borea* Auriv. ..... 7 N.
3562 *Bomolocha bijugalis* Wlk. ..... 7 E.
3571 *Bomolocha toreuta* Grt. ..... 7 E.
3670 *Cerura occidentalis gigas* McD. ..... 4—6 C. P. N. B.
3719 *Olene grisefacta* Dyar ..... 7 N.
3750 *Malacosma pluvialis* Dyar ..... 7 N.
3945 *Carsia paludata alpinata* Pack. ..... 8 L.
N.S. *Orthanama evansi* McD. ..... 7 E.
4148 *Eupithecia obumbrata* Tayl. ..... 7 E.
N.S. *Eupithecia nordeggensis* Cass. & Swett ..... 6—7 P. N.
4601 *Aethalura anticaria fumata* B. & McD. ..... 5 E.
4627 *Erannis vancouverensis* Hlst. ..... 9 E.
4654 *Ellopia fiscellaria* Gn. ..... 9 E.

AN APPEAL

Dr. Walther Horn, of the Deutsches Entomologisches Museum, Berlin-Dahlem, Gossler-Str. 20, Germany, writes that his Museum lacks financial support and is hardly able to continue its existence. The publication which he issues, namely "Entomologische Mitteilungen," is critically feeling the financial conditions of Germany, and especially the monetary exchange. Prices of printing have risen enormously, and hopes for the future are very dim. On account of the condition of the exchange, subscriptions to the journal, when sent in German marks, are not welcome, because of the constant and extremely rapid decline in value of the mark. Doctor Horn wishes that American subscribers to the journal should send their subscription price ($1.25) in American or Canadian money; and if this is done, and if more subscriptions are sent in, he hopes that the journal may be able to continue.

AN APPARENTLY UNDESCRIBED SPECIES OF *SCELLUS* (DOLICHOPODIDAE, DIPTERA)*

BY C. HOWARD CURRAN,
Ottawa, Ont.

Scellus amplus new species.

Middle tibiae swollen and polished at apex, with a long spine just before the swelling beneath; front basitarsus with a long spine below before the middle and two or three smaller ones. Allied to *filiferus* Lw., but that species has numerous shorter spines on front basitarsi and dense ciliate hairs behind on the middle tibiae.

Length, almost 5 mm., wing 6.5 mm. *Male.* Face narrow, widened below, ochre yellow; front yellow with some ochre pollen; the ground color bronze green; occiput yellow, with cupreous reflections. Palpi yellow, proboscis black. Antennae black, shining; third joint elongate oval, sub-pointed above, a little swollen at the origin of the arista; not shining, with short whitish hair. Basal portion rather thick; last section slender, curved about its middle.

Thorax cupreous bronzed, rather thickly greyish pollinose, but not ocmpletely obscuring the ground color dorsum with two narrowly separated median brownish stripes, abbreviated behind, and an obscure, similarly colored stripe above the wings. Each of the few hairs arises from a black spot. Pleura much less densely pollinose. Scutellum moderately pollinose.

Legs black, femora bronzed, tibiae more greenish. Fore femora thick basally, gradually tapering. Anterior tibiae with the sub-basal spur black, its upper surface yellow pollinose, and with pale yellowish hairs; just below the origin of the spur, on the outer side a long black spine, with a shorter one above it; apex of tibiae produced as a rather broad, blunt lobe, which is of about the same length as the last tarsal joint; the lobe behind with three or four black bristles, its anterior and apical margin with a fringe of short, black hairs; immediately above the lobe in front the tibia is fringed with yellow hairs, dense and longer apically; beneath towards the front is a row of black bristles, longer apically, behind, on the swollen sub-basal fourth with much longer bristles. Front basitarsi postero-ventrally, just before the middle, with a long bristle and two or three short ones before it on posterior surface. Middle femora strongly arcuate, the apical two-thirds swollen, beneath, on the hind surface with a single row of black bristles, but these are mixed with the long, bristly hairs on the outer half, and not distinguishable; antero-dorsally is a row of five or six bristles on the apical third. Middle tibiae also moderately arcuate and swollen on basal portion, the posterior surface flattened; bearing long, not very abundant hairs which appear slightly tufted, and especially marked on the swollen area; above the middle on the outer side with two bristles and a slightly stouter one just before the apex; apex swollen and polished, more extensively so on the posterior side; just above this area on the inner side a stout, apically curved bristle. Middle basitarsi on either side below with a row of long spines. Hind femora laterally compressed, bearing dorsally two sub-apical bristles and a posterior one just before the apical dorsal one. Hind tibiae a little

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept., of Agric., Ottawa.

curved outward when viewed from the side; their outer surface with about four equally spaced spines, their inner, posterior apical half with nine similar spines not in a regular row; the opposite surface with more or less regular hairs. Coxae greyish white pollinose, with fine yellow pile, the front ones with a row of black bristles.

Wings largely clear hyaline, but beyond the middle the cells are cinereous, fading out apically; on the crossvein is a double, fused spot occupying all either end, and a second spot on the curve of the last section of the fourth vein; there is also a streak in the discal cell, and the area behind the fifth vein from the tip of the sixth vein is darker, but fades out marginally.

Abdomen on basal four segments and side of the fifth, coppery, the fifth and sixth bronze green; except the sixth segment, rather abundantly yellowish grey pollinose. Fillaments black basally, becoming brown, the apical half yellow: the basal portion, which is directed to the upper margin of the abdomen and about one-fifth of the second portion, which is directed backwards, is black; from there to about the second third of this portion it is yellowish brown, the last third yellow; the second portion is terminated in a broad, inferior ciliae of yellow hairs, which extend all along the yellow portion, and the third portion curves obliquely upwards from this point, again curving back, but the pointed end curved a little upward; the outer upper margin of the last section, not reaching to the tip, is ciliate, with pale yellowish or white hairs, which are directed downwards so as to cover the whole of this side of the filament. The terminal lamellae are fuscous, broadened, and then ending in a pair of parallel processes, which are long, flattened and sub-pointed, each bearing four or five not long black hairs apically.

Holotype—♂, Saanich, British Columbia, May 17, 1919, (W. Downes), No. 554 in the Canadian National Collection, Ottawa.

In Aldrich's key (Ent. News, XVIII, 136) this species traces out to *filiferus* Lw. The key may be modified by placing the figure "6" instead of *filiferus* and using the following couplet:

6. Middle tibia with the apex swollen and polished and bearing a stout, curved spine on the inner side before this area ..... *amplus* Curran.

Middle tibia not with polished apex, but with such spine; with a preapical row of long, black ciliate hairs on the anterior surface .... *filiferus* Loew.

CHANGES OF NAMES

BY C. H. CURRAN,

Ottawa, Ont.

I am indebted to Mr. F. M. Hull for calling my attention to the fact that the name "*Stratiomyia velutina*" (Can. Ent., LIV, p. 233) is preoccupied (Bigot, Ann. Soc. Ent. Fr., p. 213, 1877) for a species from Chile. I propose the name "*griseata*" for the Canadian species.

In my article on the *sodalis* group appearing in this issue I overlooked the fact that Philippi (Verh. Zool.—Bot. Ges. Wien, XV, p. 747, 1865) had used the name "*Syrphus interruptus*" for a Chilean species. The name "*S. mallochi*" may be substituted for "*S. interruptus*" (antea, p. 61).

BOOK NOTICE

"Entomology with Special Reference to its Ecological Aspects," by Justus Watson Folsom, Sc. D., Assistant Professor of Entomology at the University of Illinois, third revised edition, with five plates and 308 text figures, Philadelphia; P. Blakiston's Son & Co., price $4.00.

We were very glad indeed to receive the new edition of this well-known work. The author is to be congratulated on the choice of the additional text matter which has been added. The second revised edition, published in 1913, contained 402 pages with four plates and 304 text figures, whereas this new edition contains 502 pages—one hundred pages more, as well as one additional plate and four new illustrations. Some 250 titles have been added to the bibliography and an entirely new chapter on insect ecology is included. This new chapter discusses at considerable length and under definite sub-headings: I—Conditions of terrestrial existence; II—Conditions of aquatic existence; III—Environmental factors in general; IV—Classification of environments; V—Communities; VI—Examples of insect communities; and VII—Succession. In the words of the author, "This ought to prove useful, as the literature of the subject is scattered and there has been no similar comprehensive treatment of ecology from the viewpoint of the entomologist. In the preparation of this chapter, the author has been fortunate in having the expert advice of Professor V. E. Shelford, of the University of Illinois, who is not responsible, however, for any possible shortcomings in the chapter."

On page 187 we notice that the name *Cyaniris pseudargiolus* is used; according to the "Barnes & McDunnough Check List" this Lycaenid should be referred to as *Lycaenopsis pseudargiolus*, with the summer form as *neglecta* and *neglecta-major, pseudargiolus* proper replacing the name *violacea* as used by Folsom. Likewise, on the same page *Iphiclides ajax* should be referred to as *Papilio marcellus* Cram. with the respective forms *lecontei, telamonides* and *marcellus*.

A. G.

Mailed Monday, April 16th, 1923.

Have the following entomological literature for sale or exchange. Complete with index and unbound unless otherwise noted:
Journal Economic Entomology, I to VII.
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Journal Economic Biology (London) VI.
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Address, Department of Entomology,
Oregon Agricultural College, Corvallis, Oregon.

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POPULAR AND PRACTICAL ENTOMOLOGY

THE HOST SELECTION PRINCIPLE AS ADVANCED BY WALSH*

BY F. C. CRAIGHEAD,

Ottawa, Ont.

Shortly after the publication of the results of certain experiments[1] on the host plants by several cerambycid beetles, the writer received a letter from Dr. Nathan Banks calling his attention to two very important papers by Walsh[2],[3] in 1864 and 1865. Unfortunately, these papers were entirely overlooked. That Dr. Walsh fully appreciated the extent to which many species, or better, his "phytophagic species" are restricted to a certain plant is fully attested by his statements, which are quoted. In fact, he is probably the first entomologist to state definitely this principle in concise wording. The following quotation is taken from page 405-406-407, Volume III.

"Even with the little we know of the Laws of Inheritance, we might infer a *priori*, that when from peculiar circumstances a Phytophagic Variety, including both the sexes, has fed for a great many generations upon one particular plant of the number inhabited by the species to which it belongs, it would be likely to transmit to its descendants in the imago state a tendency to select that particular plant upon which to deposit its eggs. We know, for example, that young pointer puppies, when taken into the field, will frequently point game without any instruction or training whatever, though the habit of pointing is clearly an acquired and not a natural habit, and must have been transmitted to them from their ancestors in virtue of the Laws of Inheritance. If, then, it should so happen that, owing to the presence of but a single species of the plants ordinarily fed upon by a particular species of insects, or to other causes, eggs have been uniformly deposited by a Phytophagic Variety upon the same plant for an indefinitely long series of generations—say fifty, or a hundred, or a thousand, or ten thousand—and the female has in no case intercrossed with a male belonging to a different Phytophagic Variety, then it is probable that habit will have become a second nature, and that it will cease to be possible for that insect, which by the supposition has fed upon that one plant for a very long series of years, to feed upon any other plant than that to which it has become habituated by the Laws of Inheritance.

"But before this point is reached, another series of phenomena will have come into play. Every naturalist is aware that species often run into what are known as geographical races, when separated into two or more distinct groups

*—Contribution from the Division of Forest Insects, Entomological Branch, Dept. of Agric., Ottawa.

1—Hopkins Host-Selection Principle as Related to Certain Cerambycid Beetles, Journ. Agr. Research Vol. XXII No. 4, pp. 189-220, Oct. 22, 1922.

2—On Phytophagic Varieties and Phytophagic Species by B. D. Walsh, Proc. of th Ent. Soc. of Philadelphia, Vol. III, 1864, page 403-430.

3—Same title and publication Vol. IV 1865, p. 194-216.

by physical barriers. Just so the Phytophagic Variety, having by the supposition been isolated from the other members of its species, will often run into what may be called Phytophagic Races, and finally, perhaps, acquire either a moral indisposition, or a physical inability, to intercross with the other members of the species. It will then have become what I propose to call a Phytophagic Species, distinguished from the other members of the species to which it originally belonged by certain slight peculiarities of size, or of coloration, or occasionally even of structure, just as geographical races are so distinguished. But there will be this essential difference between the two cases: Geographical Races are connected, or supposed to be connected, by all the intermediate grades, and may therefore be reasonably concluded to intercross on the confines of their geographical boundaries. Phytophagic Species are not so connected, and by the supposition they do not intercross, or, at all events, only in very rare instances, as is sometimes the case with what are allowed on all hands to be distinct species.

"According to my views, Phytophagic Species are as truly distinct species as those which differ by much stronger characters. 'The only valid practical criterion,' as I have already said, (Proc. Ent. Soc. Phil. II, p. 220) of specific distinctness is the general non-existence, either actually ascertained or analogically inferred, of intermediate grades in the distinctive characters, whence we may reasonably conclude that the two supposed species are distinct, i. e., that they do not now in general mix sexually together, or if geographically separated, that they would not do so, supposing them to be placed in juxtaposition."

He has further substantiated his remarks by experiments on several species and many careful observations in nature.

It will be seen from the following quotation how similar are the results to those which the writer expresses in 1921.

"Hence, we may conclude, first, that *tessellaris* may, without very material injury to its health, be shifted on to Oak from the other trees on which it naturally feeds; for although, of those that were retained on oak, a much larger percentage spun up than of those that were shifted on to oak from other trees, yet a considerable percentage of the former, and none whatever of the latter, died in confinement. Second. That sycamore is not a congenial food for *tessellaris*; for a considerable percentage of those fed on sycamore died in confinement, and but a small percentage spun up. Third. That oak is abhorrent to *Harrisii* as a food plant. It may seem strange at the first view, that *tessellaris* can be compelled to feed upon sycamore up to the time of its assuming the pupa state, and *Harrisii* cannot be compelled to feed for any length of time upon oak; but when we consider that in a state of nature the former is polyphagous and the latter monophagous, our surprise will cease. It is not that *Harrisii* does not eat the oak-leaves furnished to it—for the quantity of excrement on the floor of the breeding-cage at each shifting and cleaning out proved that it must eat them—but that, having eaten them, it either perishes of disease superinduced by the unnatural food, or bores its way out in despair through the millinet of the cage, or devours its own brethren in default of its natural food-plant.

"It will be observed from the table that in Nos. 5, 6, and 7 the average

number of days when the larvae were found missing is small, being only a little over four days; whereas in Nos. 3 and 4 it is large, being a little over sixteen and a half days. The reason of this difference is, that in the former, as soon as the larvae were placed on the leaves they commenced endeavouring to escape; whereas in the latter, they mostly stayed contentedly on the leaves until they were full-grown, when many escaped from the breeding-cage, probably in search of a more convenient place in which to spin up."

On page 411, Vol III, he writes as follows: "That there may be no mistake, it may be as well to say here that the difference between what I call a Phytophagic Variety and what I call a Phytophagic Species is simply this: The former habitually intercross with the normal race, the latter do not." In this connection the writer called attention (former citation) to the fact that several species in his experiments, after having bred in the same wood for two or three years, did not copulate as readily with other host strains as did those from the same plant.

In this same paper are some words of consolation to those who are working on the larval stages of insects and find many striking anomalies between the present adult classification and those suggested by larval characters. Dr. Walsh writes: "No entomologist hesitates to consider two imagos as distinct species, merely because the larvae are undistinguishable. In many families, indeed, e. g. *Cynipidae, Apidae* and *Muscidae,* very many larvae bear so close a resemblance to each other that he would be a bold man who pretended to distinguish them. Why then refuse to consider two well characterized larvae, like *tessellaris* and *Harrisii,* as distinct species, merely because their imagos are undistinguishable? Why lay all the stress upon the characters of the imago, and none at all upon those of the larva or pupa? This is as irrational, as if an entomologist were to cut off and throw away the wings and legs of every imago which he is studying, and persist in classifying it from the consideration of its body alone; much in the same way as conchologists used formerly to neglect and undervalue all the soft parts of Mollusk, and decide on its systematic affinities only from the characters of its shell.

"On the general principle that, whenever two insects differ by constant and well-marked characters in any of their states, whether egg, larva, pupa or imago, they must be specially distinct, unless they be the sexes of other dimorphous forms of one and the same species, the case of *tessellaris* and *Harrisii* might be rested here."

Walsh's discussion of *Cyllene pictus* and *C. robiniae* were particularly interesting to me as a coleopterist studying the larvae. No one now hesitates to pronounce these two insects, the one from hickory and also many other plants, the other only from black locust, as distinct species, in fact the larvae are easily separated, more readily perhaps than the adults. Walsh points out remarkable difference between the larvae of *C. robiniae* and *pictus*—the latter furnished him by Osten Sacken. Unfortunately, this was not the larvae of *Cyllene pictus*, but very likely that of *Xylotrechus colonus*. Although Walsh was probably not so familiar with the anatomical structures of these larvae as we know them today, his keen power of observation and deduction are well illustrated by his skepticism as to the identity of the larvae from Osten Sacken. On page 204, Vol IV, he

says, "Can it be possible, that of two such closely allied species as *robiniae* and *pictus*, one is apod in the larval state and the other has distinct feet?" This was from a description of *C. pictus* by Osten Sacken, before receiving the larvae from him. After examining the actual specimen, in a footnote, page 205, Vol. III, he further comments on the remarkable differences, and though apparently accepting the facts as supported by the specimens, does so very dubiously, stating, "On the whole, I am inclined to believe the larvae of *C. pictus* is really apod, and that of *C. robiniae* really six-footed; but as this is so remarkable an anomaly, it would be very desirable to verify the facts by further observations."

These larval comments are somewhat off the subject of this article, yet I thought it worth while to mention them as an example of his keen power of observation. When we consider how little has been known of the characters of the Cerambycid larvae, Walsh's comments are all the more remarkable. As recently as 1912 Webb[4] confused *Cyllene pictus* and *Xylotrechus colonus* larvae. This can easily occur, since both feed in the same logs. *Cyllene pictus* pupates and transforms to adult in the late summer, all the brood transforming about the same time while *X. colonus* larvae all overwinter as larvae except a few, which emerge as beetles in the late summer. Consequently, it is a simple matter to collect pupae or adults of *C. pictus* and associate the larvae of *X. colonus* in the same wood with them.

Space hardly permits me to comment on these papers as fully as I would like, as there is a certain pleasure in finding one's own observations so completely verified, even though antedated. In fact, practically all the conclusions to which the writer arrived after a rather lengthy series of experiments have been expressed some fifty years previously by Dr. Walsh.

THE DATA OF ENTOMOLOGY

BY T. D. A. COCKERELL,

University of Colorado, Boulder, Colo.

It is a curious fact that artists, some of them highly competent and distinguished, will not rarely paint quite impossible butterflies while the flowers or human figures in the same pictures are well and accurately drawn. Zoologists, whose discussions of animals are conscientiously precise, will misquote and misspell the names of plants. Entomologists, whose morphological studies command our admiration and respect, will be careless and inaccurate in citing localities. Thus we find that the training acquired in a narrow field is not necessarily carried over to or effective in fields which are closely adjacent. The truth of the matter seems to be, not so much that the training *cannot* be made effective elsewhere, as that it *is* not made to function through *lack of interest*. Thus, the old debate concerning the value of the classics has often missed the real point. No doubt a sound classical education develops the powers of the mind; but we have to complain of the classically educated, because they so often remain ignorant of and indifferent to other matters of serious importance. It

4—Webb, J. L. A Preliminary Synopsis of Cerambycoid Larvae. Tech. Series No. 20, Part v, U. S. D. A. 1912.

is of no avail that they might do things, so long as they will not. The immediate cause of these remarks is the receipt of the misnamed "Insecutor Inscitiæ Menstruus" for July-September, 1922, containing a description of the new species, *Chilosia sonoriana* Shannon, said to be from Las Vegas, New Mexico, 11,000 ft. altitude. The altitude given is not that of Las Vegas, and the specimens came from the Las Vegas Range, as the label surely stated. The specific name is inappropriate for an insect which inhabits the Hudsonian Zone. It seems worth while to present a few other corrections, as later on it will be difficult to eradicate the errors from the literature. It ought to be said that errors of this type are not infrequently due to preparators rather than authors. I could cite rather numerous cases of misspelled or other erroneous printed labels, placed on whole series of specimens in museums.

Apanteles cockerelli Muesebeck, 1920. Cited from "New Mexico"; the precise locality was Mesilla. I am afraid I was to blame here, as in my earlier collecting I used numbers, and failed to put the proper data on the labels.

Prosopis rudbeckiae granulatus Metz, 1911. No locality given. The specimens are in American Museum of Natural History; three are from Ormsby County, Nevada (*Baker*), which I will now designate as the type locality. One is from Woods Creek, Kings River Canyon, California, 8,000 ft., June 16, 1910 (*Metz*).

Zagrammosoma americana Girault, 1916. "Boulder, Col. (Cockerell)." It was probably collected by Bethel, and from southern Colorado.

Agromyza indecisa Malloch, 1913. "Las Vegas, 11,000 ft." Should be Las Vegas Range.

Agromyza minima Malloch, 1913. "Mescalero, Mexico." Should be New Mexico.

Incurvaria sedella Busck, 1915. "Boulder." Should be Boulder Canyon.

As our data become more complete, the significance of additional records can be better appreciated. If authors would endeavor to present the facts in relation to others, their papers would be more interesting. Thus, I have just identified a female of *Malissodes suffusa* Cresson, overlooked in my boxes, which I collected at Socarro, New Mexico, at flowers of a species of Compositae, June 29, 1895. I noted that it was hard to catch. This information, as it stands, is of little interest, but we may add the following: *M. suffusa* is a well-known species of Texas, extending to Lower California. It has been taken at Flagstaff, Arizona, where it seemed far out of its range, especially as many years of collecting had apparently revealed no trace of it in New Mexico. Now it proves that it does occur rarely in New Mexico, visiting Compositae as in Texas. The Socarro specimen is narrower and less robust than one from Texas. Thus the significance of the new record appears, and the reader is left with a question in his mind: Why is the insect so wide spread in New Mexico and Arizona, and yet so scarce there? Is it invading that part of the country, or is it an old inhabitant, now on the wane?

THE DISTRIBUTION AND FORMS OF LYGAEUS KALMII STAL, WITH REMARKS ON INSECT ZOOGEOGRAPHY (HEMIPTERA, LYGAEIDAE)[1]

BY H. M. PARSHLEY,

Northampton, Mass.

For several years I have been interested in gathering data on the distribution of *Lygaeus kalmii* Stal, a Lygaeid which occurs commonly throughout the greater part of the North American continent. Examination of the materials contained in the United States National Museum, the Canadian National Collection at Ottawa, and many other institutional and private collections has afforded a very extensive set of records, now grown sufficient, I think, to warrant detailed presentation. The study of this body of data throws light on several questions, which may be introduced by a brief review of the taxonomic history of the species.

In connection with his original description[2] of *L. kalmii,* Stal distinguished three color varieties, *a, b,* and *c,* based on the varying development of the red pronotal fascia and of the white membranal spots, to which Montandon[3] added a fourth, the melanic var. *melanodermus.* Uhler,[4] discussing *kalmii* (by inference) and related species, advanced the idea that contrary to Montandon's views these forms should be united under the name *turcicus* Fabr., but subsequent investigation has not shown this contention to be well founded; variation is not, as Uhler thought, continuous between them. The next event in this history was the subdivision of *L. kalmii* into two subspecies, which I was led to propose[5] after a study of newly acquired data. I restricted the name *kalmii* to the western race (which includes Stal's vars. *a* and *b*) and suggested the name *angustomarginatus* for the eastern form (which includes Stal's var. *c*). Finally, in my friend, H. G. Barber's, excellent revision of the genus Lygaeus,[6] the specific standing of *kalmii* is maintained and my subspecific arrangement is recognized.

Before considering the zoogeographical data referred to above, we must discuss briefly the status of the numerous color variations which are to be observed in any extensive series of *kalmii,* from any locality, only a few of which were singled out for attention by Stal and Montandon. Study of a very large amount of material shows clearly, I think, that no varietal forms worth naming can be established upon these color characters—variations in the red pronotal band and the membranal spots (Stal) or in degree of darkness in general pigmentation (Montandon). All of these criteria exhibit infinitesimal intergradation, even in material from a single locality, and the supposed melanism is, to judge from my experience, largely if not wholly due to post mortem discoloration.

The two subspecies or geographical races of *L. kalmii* are so clearly distinguishable in habitus that the experienced student needs no locality label to tell whether any given specimen is of eastern or of western origin (except for

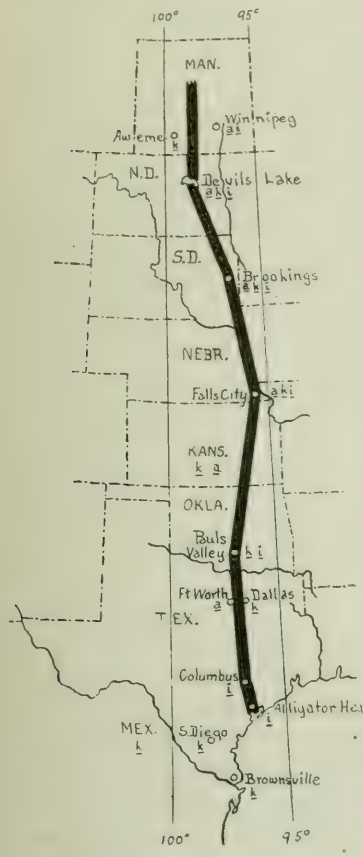
1—Contributions from the Department of Zoology, Smith College, No. 100.
2—Enum. Hem. 4: 167, 1874.
3—Lyg. exot., Ann. Soc. Ent. Belgique, XXXVII: 400, 1893.
4—Obs. Het. Hem. L. Calif., Proc. California Ac. Sci., (2) IV: 246, 1894.
5—Hem. Western Canada., Occas. papers Mus. Zool. Univ. Michigan, No. 71: 14, 1919.
6—Proc. Biol. Soc. Washington, XXIII: 63-68, 1921 (Treats only the American species).

the very rare intermediates to be discussed presently). This divergence is due to the combined effect of a number of characters, of which the chief may be tabulated as follows:

Membrane with two usually large discal white spots, and with a broad, white margin; the red band between corium and membrane strongly narrowed at middle; dorsal dark areas grayish black (western) ... subsp. *kalmii* Stal, typ.

Membrane usually without spots, rarely with small ones, the white margin extremely narrow or absent; red band not so strongly narrowed; dark areas nearly or quite dead black (eastern) .... subsp. *angustomarginatus* Parsh.

The distribution of *L. kalmii* is shown by provinces and states in the accompanying table. It will be noted that the two subspecies occupy distinct territory, except for the area in which their ranges meet, and since it is this intermediate region which has greatest interest for us, I have prepared a map of it to show graphically and in detail the facts disclosed by my study of the records. Three points are emphasized: (1) the most eastern occurrences of *L. k. kalmii*; (2) the most western occurrences of *L. k. angustomarginatus;* (3) occurrences of all known intermediate individuals. When these three are plotted it is at once seen that they lie on or near a north and south line running between the 95th the 100th meridians from Canada to Texas. This is indicated on the map by the heavy line, which thus represents conventionally the very narrow common territory of the two subspecies, the only area where, according to present knowledge, there are influences at work tending to produce individuals of intergradational type. What these influences are cannot be deduced with certainty from the data, but it seems reasonable to suppose that they are either environmental or genetic.



Map showing where the subspecies of *Lygaeus kalmii* meet. *a*, extreme western records of subsp. *angustomarginatus*; *k*, extreme eastern records of subsp. *kalmii*; *i*, records of individuals of intermediate character.

The environmental factors are yet to be worked out in detail, but some light is thrown on the question in a general way by a consideration of the physiographic character of the region. Comparison of our map with that accompanying Fenneman's work[8] on the physiographic divisions of the United States shows that the line of contact between the subspecies of *kalmii* corresponds, almost coincides, with the line which separates two physiographic provinces, the Central Lowland and the Great Plains, which are rather strongly contrasted in character. This correspondence I take to be very significant, and, depending upon it, I venture to predict that the two

8—Ann. Assoc. Am. Geog., VI: 19-98, 1917.

subspecies will prove to be separated by the Smoky Hills in Kansas, from which state I have at present no definitely localized records. Throughout much of the intermediate region, however, the transition is rather gradual in character, which may in some way account for the intergrading of the subspecies, as often happens, we are given to understand, in the case of vertebrates; but it seems to me to be at least equally probable that interbreeding would produce the same result. If we accept the reasonable assumption that the characters of the subspecies are dependent on multiple genetic factors, then we would expect to find graded intermediate series among offspring, in places where individuals of the two races occasionally meet and reproduce. This, the evidence tends to show, must happen but rarely, or intergrades would be more numerous in collections. If *kalmii* and *angustomarginatus* are incipient species, we may suppose that psychological or even anatomical barriers to intercourse have begun to rise between them.

TABLE SHOWING THE DISTRIBUTION OF LYGAEUS KALMII[7]

L. k. kalmii	Both subspecies	
Alberta	*Manitoba	New York
Saskatchewan	*North Dakota	New Jersey
Manitoba	*South Dakota	Pennsylvania
British Columbia	*Nebraska	Maryland
Washington	Kansas	District of Columbia
Idaho	*Texas	Virginia
North Dakota		North Carolina
South Dakota		Georgia
Oregon	L. k. angustomarginatus	Florida (?)
Wyoming		North Dakota
Nebraska		South Dakota
California	Nova Scotia	Wisconsin
Nevada	Quebec	Michigan
Utah	Ontario	Nebraska
Colorado	Manitoba	Iowa
Kansas	Maine	Illinois
Arizona	New Hampshire	Ohio
New Mexico	Vermont	Kansas
*Oklahoma	Massachusetts	Missouri
Texas	Rhode Island	Texas
Mexico	Connecticut	Mississippi

The intermediate individuals (whose occurrence is designated on the map by *i*) are diverse, some tending toward the western type, some toward the eastern. We may indicate their general nature by the description of several, bearing in mind that they all *look* intermediate. The Manitoba specimen has rather small membranal spots, a margin of intermediate width, and red bands of the western type. Several from North Dakota (kindly provided by Mr. R. F. Hussey) exhibit gradation in the white markings and in the grayness of the surface but have red bands of the western character. The South Dakota indi-

7—The asterisk (*) indicates the occurrence of intermediates.

vidual is similar, but has the white markings much reduced. An Oklahoma specimen has a very narrow membranal margin, but is otherwise almost typically western, while one from Columbus, Texas, is similar but lacks the white spots entirely.

This study brings to mind certain matters which may be lightly touched upon in conclusion. In the first place, it emphasizes again the importance of detailed faunistic work. It used to be the fashion to deride local lists and those who wrote and published them, but styles change and it is now clear to almost everyone that it is just this sort of work (granted the taxonomic foundation) which is most necessary for progress in zoogeography—just this which is almost always found to be insufficient or totally lacking when the distribution of a single species is undertaken as an object of study. Moreover, it is not enough to present a list of accurately identified species; detailed locality records of infraspecific forms must also be given. Here is implied the best argument for the naming of varieties, *i. e.*, recognizable forms of less than specific value, intergrading and interbreeding (at least inferentially) with the typical form of the species, and not known to be separated geographically. If such forms are not described and named (under the noncommittal designation *variety*) there is little likelihood that sufficient data pertaining to them will ever be accumulated to show whether or not they belong in reality to the important category designated synonymously as subspecies, geographical race, or incipent species. In this connection I note with interest some observations in the latest paper of Mr. Morgan Hebard[9], one of the few entomologists whose distributional work can be considered adequate from our present point of view. A brief quotation from his article will serve to point my investigation of *Lygaeus kalmii*. Discussing the two races of *Radinotatum brevipenne*, a Floridian locust, he says: ". . . . . an area of intergradation lies between the geographic races of a species, unless the latter be insular or has in some other manner been completely separated from the parent stock.....Both races are individually variable, but any series from southern Florida may be easily separated from any series from the northern portion of the species' range." The definitions and concepts (regarding the subspecies especially) which I am emphasizing in this report may seem commonplace or even platitudinous to the student of vertebrate distribution, but they are certainly not so in the field of entomology; there are even recent papers on insects in which the terms *subspecies* and *variety* are used interchangeably, and in the highly developed subject of myrmecology the word subspecies has, I believe, a peculiar connotation. It is a matter of the greatest biological interest to observe phenomena which are identical in vertebrates and in insects, both so far advanced along widely divergent paths of evolution, and it would seem highly desirable to maintain in such cases a similarly identical terminology.

9—N. Am. Acrididae, Achuri, Trans. Am. Ent. Soc., XLVIII: 89-102, 1922.

NOTES ON PTEROPHORIDAE WITH DESCRIPTIONS OF NEW SPECIES*

BY J. McDUNNOUGH,

Ottawa, Ont.

Pterophorus (Oxyptilus) cygnus B. & L.

In working over the material in the Canadian National Collection of the genus *Pterophorus* in the light of Dr. Lindsey's revision (Barnes & Lindsey, Cont. Nat. Hist Lep. N. Am. IV (4) pp. 297—308) I was surprised to find that all the specimens under the name *tenuidactylus* Fitch were referable, according to genitalia, to *cygnus* B. & L. This species was described from a single ♂ specimen from Iowa City, Iowa, and, apart from genitalia, was diagnosed as differing from true *tenuidactylus* by the presence of white markings on the fourth abdominal segment. While there is no doubt about the agreement of the genitalic slides of our Canadian specimens with Lindsey's figures of *cygnus*, (Pl. XLIX, fig. 2), they certainly do not fit in with the above diagnosis, but appear to have the same abdominal markings as those ascribed to *tenuidactylus*, that is to say, oblique white stripes on the third abdominal segment meeting in the centro-dorsal line to form an inverted V mark, a brown fourth segment, and a fifth segment which is largly white; this latter is especially the case with the females, of which there are six very perfect specimens from Ottawa before me. Through the kindness of Dr. Wm. Barnes I have had the opportunity of examining a series of specimens of *tenuidactylus* from his collection, as determined by Dr. Lindsey; the series includes three males and the genitalia of these (examined *in situ*) agree both with our own specimens and with Lindsey's fig. 2 (*cygnus*); the maculation is also similar. Under the circumstances it would seem that there had been a mix-up of slide material and that fig. 2 (Pl. XLIX) really refers to *tenuidactylus*, which would bring it into line with Fernald's monograph. Whether fig. 1 of the same plate should be referred to *cygnus*, in place of *tenuidactylus*, can only be decided when more material from the type locality of the former species is available for study.

Pterophorus evansi n. sp.

Palpi slightly shorter than those of the preceding species. Primaries very similar in colour and maculation but the brown somewhat duller and the second lobe slightly narrower and with less excavated outer margin. Third lobe of secondaries with less distinct white median area preceding black tuft than in *tenuidactylus*, this area being suffused with brown scaling. Hind legs with median pair of spurs just beyond middle of the tibia (differs from *ningoris* in this respect) and with both a dorsal and an outer lateral brown longitudinal stripe, whereas in *tenuidactylus* only the lateral stripe is present. The abdominal markings are quite distinct from those mentioned above for *tenuidactylus*; there is no markedly white segment except the first and the remainder of the abdomen is brown with white oblique, inverted V-shaped, dorsal lines and a lateral white line in the stigmatal region above the flange; beneath largely white

*—Contribution from Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

with brown longitudinal lines. In general the species is closest to *raptor* Meyr., but differs in the position of the median spurs of the hind tibiae. The genitalia are quite distinct from those of any of the described species; the ventral plate is similar to that of *ningoris* as figured by Lindsey (l. c. Pl. XLIX, fig. 6) but the distal prongs are longer; the clasper is of more or less even width throughout its entire length, the apex being truncate with the ventral edge produced downward into a blunt point, giving somewhat the appearance of a bird's bill; in this respect it resembles Lindsey's figure of *periscelidactylus*, the produced portion, however, being shorter and broader. Expanse 14 mm.

Holotype—1 ♂, Trenton, Ont. (July 18, '11) (J. D. Evans); No. 556, in the Canadian National Collection.

Allotype—1 ♀, Trenton, Ont., (July 17, '11) (J. D. Evans); in the Canadian National Collection.

Paratypes—3 ♂, 3 ♀, same locality and collector, taken at various dates in July except a single ♂ which was captured June 4.

I take pleasure in naming this species after one of the pioneer entomologists of Canada, whose collection is now incorporated in the National Collection at Ottawa. A single ♂ is before me from Aweme, Man.; this record extends the distribution of the species considerably westward.

Platyptilia williamsi Grin.

A long series captured by me at Nordegg, Alta. seems referable to *williamsi*, a species which has heretofore been scarcely represented in collections. Specimens came commonly to light in late June and the first half of July and the series before me shows considerable range of variation in brightness of colour and amount of brown shading on first lobe of primaries. A superficial examination of the male claspers shows them to be close to those of *percnodactyla*; in general appearance our specimens run closer to *edwardsi*, from which they are readily separated by the central position of the scale tooth on the third lobe of the secondaries.

Stenoptilia bowmani n. sp.

Primaries dull gray-brown with white scaling as follows:—along the basal portion of costa and at base of wing, a small oval patch above inner margin before middle, a larger oblong rectangular patch in central portion of wing before base of cleft and slight shading on costa above base of cleft; there is a dark spot on inner margin preceding the first white patch and the larger white rectangular patch is preceded by a square blotch and followed by a more or less triangular patch with its base below and parallel to costa and apex just before base of cleft, from which it is separated by a few white scales; a faint white line crosses both lobes parallel and close to outer margin; fringes on outer margin dark inwardly, white outwardly, cut twice by a narrow white scale tuft about centre of each lobe; on the margin of lobe and on inner margin the fringes are mostly white with scattered black scaling. Secondaries dull brown with paler fringes. Thorax and abdomen gray-brown with metathorax scaled with white and with white scales laterally on abdominal segments. Legs dull gray with scarcely noticeable darker bands before spurs on hind tibiae. Expanse 20 mm.

Holotype—1 ♀, Nordegg, Alta. (June 20) (J. McDunnough); No. 559, in Canadian National Collection.

The rather checkered character of the primaries readily separates the species from any of the described forms, and I therefore venture a description based on a single specimen. The species is named after Mr. Kenneth Bowman, of Edmonton, who has been an ardent and successful collector of Lepidoptera in Alberta for a number of years.

Oidaematophorus lindseyi n. sp.

Head brown with a pale band between the antennae, thorax creamy, abdomen pale ochreous with single dark dorsal dot on posterior margin of segments. Primaries ochreous, pale creamy at base and through basal part of cell, lightly sprinkled with black dots, especially along costa, before the cleft and above inner margin near base; lobes only very faintly sprinkled. Secondaries pale smoky. Expanse 27 mm.

Holotype—1 ♂, Aweme, Man. (Aug. 15) (N. Criddle); No. 560, in Canadian National Collection.

Paratype—1 ♂, same locality, date and collector, in Canadian National Collection.

This species was referred by Lindsey in his revision (l. c. p. 392) to *cineraceus* Fish; the genitalia, however, hardly warrant this reference. The harpe in the present species forms a deep basal loop which descends half-way to the base of clasper and is much deeper than in *cineraceus* and in fact than in any of the species figured in the revision; it is closer to *grisescens* in this respect than to *cineraceus;* there is also a distinct difference in the shape and length of the juxta, the outer branch in *lindseyi* being much longer and more pointed. I consider these differences, combined with the general dissimilarity of appearance, to denote specific distinctness. I have seen a third specimen of the same species in Mr. Bowman's collection from Edmonton, Alta.

Oidaematophorus fishi Fern.

Five ♂'s in the Canadian National Collection appear to be referable to this species on genitalic characters. These are from Nordegg, Alta., (Aug. 1) (J. McDunnough), Banff, Alta, (July 28, Aug 3, 22) (C. B. Garrett) and Nicola, B. C., (July 30) (P. N. Vroom). The British Columbia specimen is the palest, the lobes being largely white, whilst two of the Banff specimens are much suffused with dark gray.

Oidaematophorus costatus B. & L.

A single ♂ collected at Nicola, B. C. (July 26) by Mr. P. N. Vroom agrees with *costatus* in genitalic characters. It lacks entirely, however, the gray shades on primaries mentioned in the original description and seems to agree very closely with the diagnosis of *australis* Grin. in general colour of primaries. More material from British Columbia and a knowledge of typical *australis* and *costatus* will be necessary before a definite determination is possible.

THE LIFE HISTORY OF EUPHYLLURA ARBUTI SCHWARZ (HEMIPTERA; CHERMIDAE)

BY G. F. FERRIS AND PERSIS HYATT,
Stanford University, Calif.

At various times during the past few years reports have been received of injury to madrone trees (*Arbutus menziesii*) in the San Francisco Bay region apparently resulting from the activities of a Chermid (Psyllid), *Euphyllura arbuti* Schwarz. The occurrence of this injury, together with the fact that the insect is of itself a very interesting species, has led to the following study. The junior author is responsible for the field notes while the senior author is responsible for the figures, descriptions of the immature stages and the actual preparation of the paper.

It is hoped that this paper may be but the first of a series dealing with the much-neglected immature stages and life histories of representatives of this family.

THE MADRONE CHERMID.

1904. *Euphyllura arbuti* Schwarz, Proc. Ent. Soc. Wash. 6: 237-8; fig. 7.
1914. *Euphyllura arbuti* Schwarz, Crawford, Bull. U. S. Nat. Mus. 85: 117; fig. 6.

Hosts and Occurrence. Originally described from specimens taken in Santa Cruz County, Calif., and as far as published records are concerned, apparently known only from this record. It is very abundant on the Santa Cruz Peninsula and has been taken by the junior author in Marin County. Information has been received of its occurrence at Mendocino City in Mendocino County. In all probability it occurs throughout the range of its host, which is from British Columbia to southern California and possibly northern Lower California.

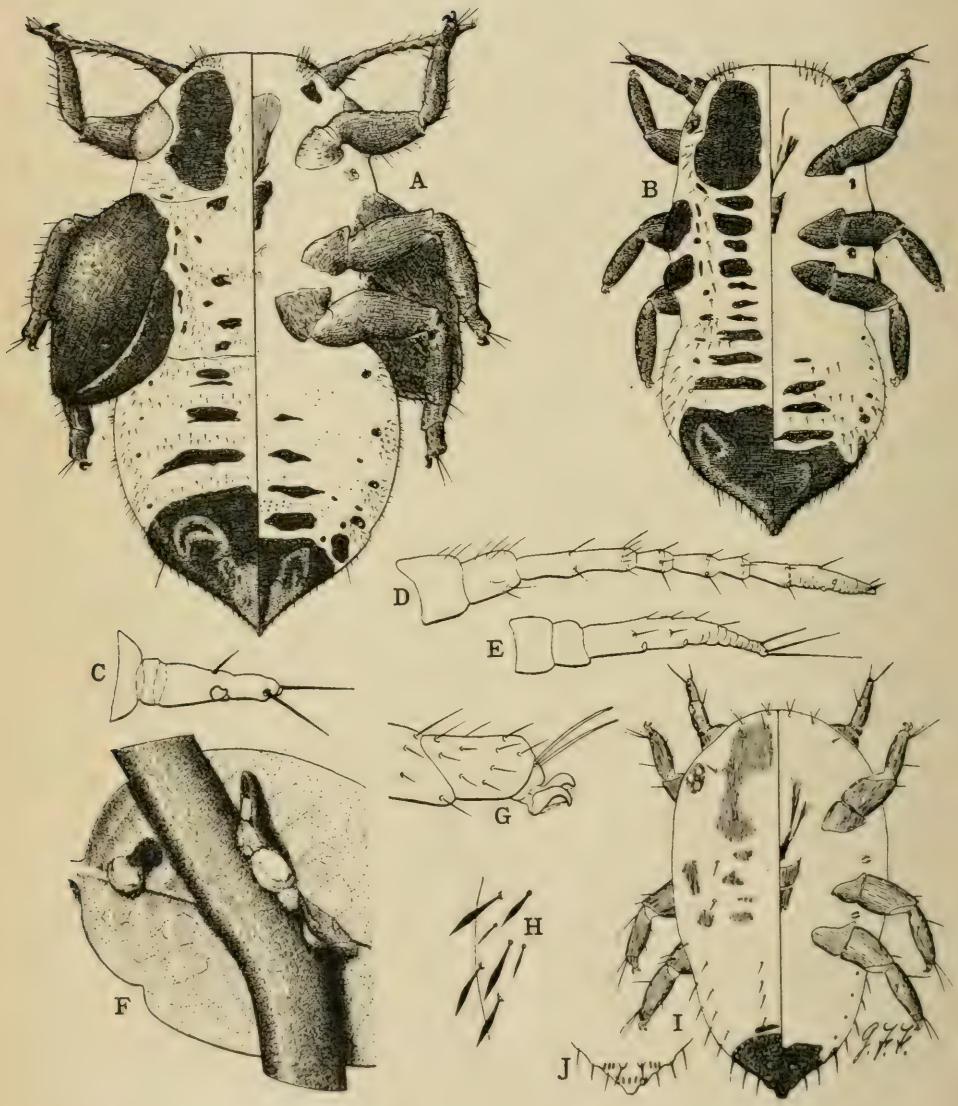
A very similar species occurs on *Arbutus arizonica* in Arizona and the other American representatives of the genus are recorded from members of the related host genus *Arctostaphylos* or *Uva-ursi*, which in California at least are commonly known as "manzanita."

Apparently *Arbutus menziesii* is the only host of *E. arbuti*. It evidently does not transfer to manzanita, for bushes of the latter have been found with their branches intertwined with those of heavily infested madrones, yet free from infestation.

General Habits. The immature stages of this species are especially interesting from the fact that the waxy secretion, which occurs so commonly in members of this family, here takes the form of a cell within which the insect is entirely enclosed until maturity. These cells are composed originally of delicate threads of pure white wax which eventually become fused into an amorphous mass and are frequently blackened with the "sooty mold" which grows in the excrement of the insect. The wax is sticky and soft at first but finally becomes hard and more or less brittle, at least in part.

Most frequently these cells (Plate II, fig. F) are found under bark scales or in other protected situations on all parts of the tree, where they may be thickly crowded together. Not infrequently, however, they occur exposed upon the leaves or the bark. It is evident that the insects "prefer" the protected situations and that the individuals thus protected have a decided advantage over those which are not. During the months of January to March in 1922

Can. Ent. Vol. LV. Plate 2.



EUPHYLLURA ARBUTI SCHWARZ

no living nymphs were found except under the cover of the bark or of new growth

All of the molts, except the last, take place within the cell and the exuviae are incorporated in the cell walls. As a rule the insect remains within its cell, but if it is disturbed, or if for any reason a change of position is necessary, it does not hesitate to leave the cell and form another.

The final molt, from which the insect emerges as an adult, always takes place outside of the cell, the nymph forcing its way out and crawling a considerable distance, frequently to the under side of a leaf where it may remain exposed for some time before the molt takes place. The fact that the earlier molts take place within the cell makes it difficult to determine their number definitely. Nor is counting the number of exuviae entangled in the cell walls a sure indication of the number of molts, for in some cases it is very evident that the insect has either moved or that some of the exuviae have been lost. In other cases it is equally evident that other wandering nymphs have been caught in the sticky walls of the cell along with the exuviae of its maker. However, it appears that there are in all five molts, and that number is here accepted as correct, the successive stages being described and numbered on this basis.

The Egg and Oviposition. The eggs are placed singly or in clusters at the axils of the stems, on petioles, new leaves, or in the folds of new growth. They are attached by a slender stalk, one end of which is thrust into the tissues of the host, and are elongate with the basal end rounded and the distal end very acute. The egg is about .47 of a millimeter long and the stalk about .5 of a millimeter. The egg is smooth and entirely free from sculpturing.

The females are capable of producing a large number of eggs. One female in the laboratory produced 83, another 203, another 324. A copulating pair was caged in the field and after eleven days 536 eggs were found. The period of incubation varies from 14 to 30 days, depending upon weather conditions.

Eggs have been found at practically all times of the year. In 1921 the first record was for May 13th and they were then observed from time to time during the summer. They were abundant in October and continued to be found through December and into January, 1922. Then very few were seen during February and March, the weather having been—for this region—quite cold. At the end of March a few scattering eggs were found and on April 24th females were seen ovipositing in the field. From that date they appeared in increasing numbers until by the end of May few twigs could be found that did not bear some eggs.

On May 4th a female copulated twice in the laboratory, the copulation lasting in the first case for 80 minutes and in the second for 30 minutes. Until May 9th this female did not move from its first position and then it moved only slightly. On May 12th eggs were found to have been laid during the night. The egg-laying period lasted for three days, a total of 203 eggs being produced.

In the field a female was seen ovipositing on April 29th and she was enclosed in a wire cage which was placed about the twig. After a week she was found to have laid 324 eggs. Another female was found in copulation on May 15th. The twig was free from eggs and a netting was placed about it. On May 20th a few eggs were found and on May 26th the number had increased to 536.

This may not have been the limit of her capacity, for at this point she escaped from the cage.

First Nymphal Stage. The first stage, upon hatching, is oval, light yellow in color, with red eyes, and is approximately .45 mm. long. Upon leaving the egg it crawls a short distance and inserts its proboscis into the host. A protected situation is sought, and so a number of individuals may congregate under a single bark scale or in a similar situation. The secretion of wax begins soon but the insect does not cover itself entirely for a week or more. The first molt occurs after the cell has been formed.

In this stage (Fig. I) the antennae (Fig. C) are short, stout and three-segmented, the first two segments very short, the third elongate, with two rather stout apical setae and a large sensorium at about its middle. The eyes are very small and three-facetted. The legs are quite short and stout, with the tarsal segment very obscure. The dorsum is beset with a pair of large, irregular chitinized areas between the eyes and several small areas on the thorax. The tip of the abdomen is heavily chitinized, both dorsally and ventrally, and bears two rings of pores (Fig. J). Setae are very few, all slender.

Second Stage. (Fig. B). This stage shows several marked differences from the first. The antennae are similar, but the first two segments are larger and the large sensorium is replaced by two small ones. The dorsal chitinized areas on the thorax are larger, more heavily chitinized and more numerous, and two of them are the very evident rudiments of the wing-pads. The chitinized area at the apex of the abdomen is much larger and the pores are arranged in quite definite areas, both dorsally and ventrally. The abdomen, both dorsally and ventrally, bears several pairs of small, chitinized areas. Setae are much more numerous, but retain the same form as in the first stage.

Third Stage. Differing from the second chiefly in the larger size of the wing pads.

Fourth Stage. Differing from the second and third chiefly in the form of the antennae (Fig. E), in which the third segment has become much elongated, and in the still larger size of the wing-pads. The eyes are larger and have a larger number of facets.

Fifth Stage. (Fig. A). Length 2.4 mm. Differing markedly from the preceding stages in the form of the antennae (Fig. D) which are now quite long and slender and seven segmented. The eyes are now large and many facetted. The chitinized areas on the dorsum of the thorax are very much smaller than in the preceding stage and the wing-pads still larger. The setae on the abdomen are for the most part of a lanceolate form (Fig. H). The tarsi (Fig. G) are distinct, one-segmented, and bear a pair of digitules. The pulvilli are very small and inconspicuous, contrasting strongly with the condition seen in some other species, where they are very large and conspicuous. No data are available as to the total duration of the nymphal period.

Adult. A sufficiently good description of this stage is given both by Schwarz and Crawford. The adults are capable of jumping and flying, but they are usually very sluggish when not disturbed. They may sit for hours, or even days, in one position, usually on a leaf petiole, with their heads pointed down and their beaks inserted into the tissues of the host.

Parasites. Three species of Chalcidoid parasites were reared from the nymphs, these being determined by Mr. A. B. Gahan as *Psyllaephagus* sp., *Pachyneuron* sp., and *Alloxysta* sp. These seem to attack chiefly, if not exclusively, the last nymphal stage, and the percentage of parasitism appears to be fairly high.

EXPLANATION OF PLATE 2.

Euphyllura arbuti Schwarz: A.—fifth and last nymphal stage; B.—second nymphal stage; C.—antenna of first nymphal stage; D.—antenna of fifth stage; E.—antenna of fourth stage; F.—nymphal cells on twig and leaf; G.—tarsus of fifth stage; H.—setae from margin of abdomen of fifth stage; I.—first nymphal stage; J.—pores at tip of abdomen of first stage.

STUDIES IN CANADIAN DIPTERA*

I. REVISION OF THE ASILID GENUS CYRTOPOGON AND ALLIED GENERA.

BY C. HOWARD CURRAN,

Ottawa, Ont.

In the series of papers to be published under this heading it is proposed to deal with various groups of Canadian Diptera in a synoptic or monographic manner. It is hoped in this way to gradually assemble a collection of papers which will be of value to students of the Canadian dipterous fauna and perhaps prove an incentive to those who at present find it impossible to determine their specimens. The literature dealing with Canadian Diptera is widely scattered and much of it unavailable, and few keys to the species and genera are available owing to the very large number described in recent years. The author will be pleased to determine specimens for Canadian collectors at any time.

The following paper is based upon material in the Canadian National Collection. Several years ago, Dr. McDunnough, Chief of the Division of Systematic Entomology, commenced the accumulation of specimens of Asilidae, and a fairly complete collection from Canada has been secured. It was found that only a few of the species of *Cyrtopogon* could be definitely determined, but owing to the absence of specimens from the type localities it was not possible to be certain that many of the species were undescribed. Recently, I visited the United States National Museum, Washington, D. C., and the Museum of Comparative Zoology, Cambridge, Mass., and examined the types in these collections, comparing specimens with them. The result has been the description of many new species in the present paper. Where specimens of other American species have been examined they are included in the table of species. Many of them probably occur in Canada.

The genus *Cyrtopogon* was found to be a somewhat complex group, and I have therefore divided it into two genera, based upon the antennal structure and wing venation, and for two species which were previously placed in the genus *Cophura* I have established a new genus, as these species are closely related to *Eucyrtopogon* and do not belong to *Cophura* in a strict sense.

The following key may be used supplementary to the key in Williston's Manual, or to Back's key. The genus *Comantella* will be readily distinguished from *Cophura* by the presence of a thoracic mane.

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa, Ont.

1. Anterior tibiae with a twisted apical spine on the inner side; middle tibiae with a stout, straight black spine on inner side ..... *Comantella* n. g.
   Anterior tibiae without such spine; middle tibiae without strongly differentiated apical spine 2
2. Third antennal joint widest basally, usually slightly tapering, the style half or more as long as third antennal joint. Third longitudinal vein branched basad of the discal crossvein; wings with clouds on all crossveins and furcations; usually smaller species, with less tapering abdomen ..... *Eucyrtopogon* n. g.
   Third antennal joint usually coarctate, its base swollen, widest at or near the middle; third longitudinal vein branching distinctly beyond the discal crossvein; wings never so distinctly clouded on crossveins, but sometimes with one or two large blotches; usually large, with more acute abdomen ..... *Cyrtopogon* Lw.

Comantella new genus

In his monograph of the Dasypogoninae, Back placed the species *cristata* Coq. and *fallei* Back, in the genus *Cophura*, at the same time noting that the genus as understood by him seemed to be a conglomeration of species, several of which showed no relationship. Comparing the species before me with Osten Sacken's description of the genus *Cophura*, I find that they cannot be included in that genus, and therefore propose the name *Comantella* for *Cyrtopogon maculosa Coq.*, (type) and *Blacodes cristatus* Coq.

The genus is very similar to *Eucyrtopogon* and is distinguished from it by the presence of a curved spur at the apex of the front tibia. All other characters are practically the same. Were it not for the fact that the species will not trace out to *Cyrtopogon* in any tables of genera I should consider the presence of the spur of little value and should include the group under the genus *Eucyrtopogon*. The spur is rather weak and often difficult to see, and this resulted in Coquillett describing *maculosa* as *Cyrtopogon* and the redescription of the same species as *Cophura fallei* by Back. The two known species possess a remarkable condensation of hair on the thorax, forming a distinct mane, a character also possessed by *E. comantis*.

Only *C. maculosa* is known to occur in Canada. The two species may be distinguished by the following synopsis:

Margin of scutellum with only four bristles ..... *cristata* Coq.
Margin of scutellum with numerous bristles (*fallei* Back) ..*maculosa* Coq.

Comantella maculosa Coquillett

Thorax with a distinct black mane; front tibiae with curved apical spur; scutellum with about twelve apical bristles.

Length, 9 to 12 mm. *Male*. Face moderately gibbose, most prominent at the middle, convexly retreating below, gently convex above, the swelling not quite reaching the base of the antennae; silvery white pollinose; mystax composed of rather coarse black hairs, their tips white. Front with similar pollen; only a small, black spot immediately above the antennae; on the sides with a few long black hairs, with many stouter, longer hairs on ocellar tubercle, their tips white. Occiput silvery white pollinose, fine white pilose, except for

a row of stout, brownish or yellow hairs above. Antennae black, thinly yellow pollinose; white pilose, the first joint with one, the second with two long black hairs below; first joint slightly longer than broad, "barrel-shaped," widest in middle, second joint slightly longer than broad, more slender than the first, and about three-fourths as long; third joint one-third longer than first two combined, broadest basally, gradually tapering on apical two-thirds, the style half as long as third joint, moderately broad, with nearly parallel sides, its spine short.

Thorax shining black in ground color, but everywhere pollinose, less thickly so on the pleura, especially below. Mesonotum sub-carinate, very high, the sloping sides very little convex, the middle forming a prominent rounded ridge which is yellowish pollinose on the middle line, and blackish on either side, the slopes greyish pollinose, with a small, darker area contiguous to the dark middle stripe between the humeri, a broad, elongate spot, widest anteriorly on the middle half, about half way between the middle and side margins, and the postalar calli brown pollinose or blackish in some lights. Pleura greyish pollinose with brown spots on meso- and sternopleura. Pile fine, rather sparse, long, white, the median crest long, black, with a few white hairs behind. Bristles black and yellowish. Sternopleura with only four or five white hairs above. Black hairs mostly white tipped. Scutellum convex, grey pollinose, its disc brownish yellow pollinose with fine white pile and eight to twelve long, black, apical bristles, one or two pairs of which may be whitish.

Legs wholly shining greenish black; the tibiae may have a narrow, more or less reddish stripe on the outer side basally; wholly white pilose, most of the hairs long, fine; bristles yellow, their apices white. Anterior tibiae with a twisted apical spine on inner side, middle tibiae with stout, black, apical spine on anterior apex.

Wings hyaline or slightly cinereous, the crossveins and furcations all clouded with brownish. The third longitudinal vein branches before the apical crossvein. Squamae whitish yellow, with white fringe. Halteres fuscous.

Abdomen shining blue black, the second segment about the basal third, just beyond a bare, flattened, polished band, and the bases of the two or three following segments, with a transverse greyish pollinose band, widest in the middle and very broadly separated from the sides. The lateral margins are wholly, broadly grey pollinose, the pollen expanded on the posterior angles to form small triangles, their anterior margin concave, the second segment except behind, more narrowly, more yellowish pollinose; seventh segment entirely pollinose or only the middle bare. Pile wholly white, moderately long, or sometimes yellowish on the disc.

Female. Style slightly longer, its basal section longer. Second antennal joint with three black bristles. Hairs of front sometimes largely whitish. Second abdominal segment apparently not pollinose laterally except posteriorly and the veins at the apex of the wing may be slightly clouded with greyish.

Redescribed from 2 ♂, 2 ♀ Penticton, B. C., April 4, 1919, (E. R. Buckell).

Specimens were compared with the type in the United States National Museum. The synonymy of *Cophura fallei* is given from comparison with description, which agrees perfectly.

Eucyrtopogon new genus

Allied to *Cyrtopogon*. Face gibbose. Third antennal joint longer than the first two combined, widest basally, gradually slightly tapering, its style half as long as third joint. Thorax convex, rarely with a prominent longitudinal ridge bearing a distinct mane, usually moderately pilose, with bristles on lateral margin; largely pollinose. Scutellum convex, with fine pile or moderately stout hair, usually with stronger apical hair or bristles. Legs not specialized, tibiae and tarsi with bristles, the former without a curved spine apically on the front pair. Abdomen of ♂ with sub-parallel sides, obtusely rounded apically; of ♀ distinctly broadest in the middle, beyond which it is tapering, the apices of the segments grey pollinose on posterior angles. Wings with the crossveins and furcations always clouded with brownish, the third vein (R_4 and R_5) branching basad of the discal crossvein (the outer vein of the discal cell). Genotype *Crytopogon nebulo* O. S.

TABLE OF SPECIES.

1. Males 2
   Females 6
2. Middle line of the thorax with a very conspicuous mane of white and black hairs ..... *comantis* n. sp.
   No condensation of pile to form a mane. 3
3. Costa with a double row of abundant, short, curved spines 4
   Costa without spinose hairs curved at right angles, the hairs much shorter; wings with two deep brown spots in first basal cell, the costa broadly brown on apical fourth ..... *varipennis* Coq.
4. The anterior apex of the hind coxae is produced forward as a conspicuous conical tubercle, lower fringe of curved hairs on costa as long as width of costal cell ..... *calcarata* n. sp.
   Hind coxae not with a conspicuous production, fringe of curved hairs not over three-quarters as long as width of costal cell 5
5. Sides of front with hoary bloom; mystax with the ends of the hairs silvery white ..... *diversipilosis* n. sp.
   Sides of front with brownish yellow bloom; mystax with ends of hairs yellow ..... *nebulo* O. S.
6. Seventh abdominal segment without sericeous pollen ..... *nebulo* O. S.
   Seventh abdominal segment with sericeous pollen 7
7. Mystax chiefly white, wings almost without villi ..... *albibarbis* n. sp.
   Mystax chiefly black, wings distinctly villous 8
8. The sericeous pollen on the sides of sixth abdominal segment reaches broadly almost or quite to the base of the segment ..... *calcarata* n. sp.
   The pollen does not extend over two-thirds the distance to the base, or only very narrowly so on the sides 9
9. Genitalia with 8 stout spines ..... *diversipilosis* n. sp.
   Genitalia with 10 or 12 stout spines ..... *spinigera* n. sp.

(to be continued)

A NEW SPECIES OF WILLIAMSONIA (ODONATA-CORDULIINAE)

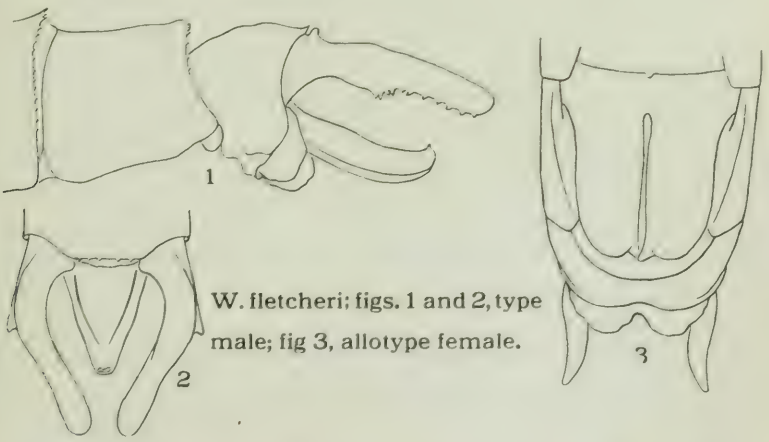
BY E. B. WILLIAMSON,

Bluffton, Ind.

Last August Dr. McDunnough kindly gave me a male and a female specimen of this genus collected near Ottawa, Canada. As I had heretofore seen only a single female of *W. lintneri*, studied years ago for Mr. Davis, and as Dr. Howe had promised me a specimen of that species, the specimens sent by Dr. McDunnough were set aside for later study. In October Dr. Howe kindly complied with his earlier promise and sent me a male of *lintneri* collected at West Roxbury, Massachusetts, May 6, 1922, by W. J. Clench. When the three specimens above enumerated were studied in connection with Hagen's description of *lintneri*, it was at one evident that two species were represented and that the Canadian specimens represented the undescribed species. I at once communicated this fact to Dr. McDunnough, who kindly sent me all the specimens of the genus in his charge, and later I obtained a female of *lintneri* for study from Dr. Howe. This female was taken at Rumford, Rhode Island, May 11, 1922 by E. D. Keith.

Williamsonia fletcheri new species.

Abdomen male 22.5—23.5, female 22—23; hind wing male 21.5—22.5, female 22—23; stigma front wing male 1.8, female 1.9—2.2; stigma hind wing male 2, female 2—2.4; hind femur 5; superior appendages male in lateral view 2, inferior appendage, 1.3; appendages female, 1.2; vulvar lamina, 1.8.



W. fletcheri; figs. 1 and 2, type male; fig 3, allotype female.

Male and female: Labium dull yellow; face and head above, including the occiput, dark to black, the anteclypeus somewhat paler and the frons with metallic bronze or greenish reflections; rear of head shining black.

Prothorax with front and hind lobes pale, yellowish; middle lobe black

Thorax and legs black; thorax with a small, ill-defined gray area anterior to each antealar sinus and with ill-defined pale brown or gray areas on the pectus; dorsum of thorax duller than the sides, which are blacker with metallic reflections.

Abdomen and appendages black with restricted pale gray or yellowish markings as follows: a lateral inferior basal spot, anterior to the genital hamules

on 2; the integument between 2 and 3; a lateral inferior basal or subbasal spot on 3, reaching apically to midlength of the segment in the male and to the apex in the female; the integument between 3 and 4; in the male the merest vestige, on the extreme inferior border of the basal half of 4, of the homologue of the spot on 3; in the female the stripe on 4 is similar to the stripe on 3, but is reduced and does not quite reach the apex; integument between 4 and 5, almost as dark as the segments in the male, more distinctly pale in the female; 5 without markings in the male, in the female the homologue of the spot on 4 present but more reduced.

Wings hyaline, orange tinged at base, very reduced in the front wings; extending about half way to the first antenodal and to the cubito-anal cross-vein or slightly less in the hind wing, and more or less in the anal triangle along its basal vein, opposite the white or nearly white membranule, which is more or less grayish tinged in the male, especially posteriorly and along the inner border; veins black except the costa, which is yellowish to at least the nodus; stigma brown. Antenodals in front wing, 7 in five male and three female wings, 8 in four male and five female wings, and 10 in one male wing; antenodals in hind wing 4 in one female wing, 5 in eight male and six female wings, 6 in one female wing and 7 in two male wings; postnodals in front wing 5 in two male wings, 6 in three male and two female wings and 7 in five male and six female wings; postnodals in hind wing 5 in one male and one female wings, 6 in five male and one female wings, 7 in three male and five female wings and 8 in one male and one female wings; postanal cell in front wing one-celled in four male and three female wings, two-celled in six male and five female wings; subtriangle front wing free in every case but in one female wing where it is once crossed; one cubito-anal cross-vein in all the hind wings and in all the front wings but two male wings (in one of these the added cross-vein is proximal to the true cross-vein and in the other case it is distal and is under the arculus); anal triangle of male one-celled in four wings, two-celled in six wings. (Variations in venational characters of generic value have not been detected, so such characters are not discussed in the above specific description).

Accessory genitalia of male similar to that of *W. lintneri* and briefly described in a following paragraph discussing the genus. Male abdominal appendages also in general similar to those of *lintneri*, but more arcuate in dorsal view and with the ventral teeth on the apical three-fifths of the superior appendages larger. Female abdominal appendages more tapering apically, less uniformly cylindrical, and more acute than those of *W. lintneri*. Vulvar lamina black, longer than segment 9 in the middorsal line, nearly reaching the apex of the sternum of 9, divided for a distance of two-thirds to three-fourths its length, slightly but distinctly elevated, the posterior mesal angle of each lobe produced into a short triangular apex, which is directed meso-dorso-posteriorly. It is distinctly different from that of *lintneri* by its greater length, its slightly elevated position, and the triangular mesal apex of each lobe.

Described from six males and four females all from Mer Bleue, Ottawa, Ontario, Canada; May 25, 1908, and June 4, 1908, (two males, C. H. Young), May 23, 1922 (three males and four females, J. H. McDunnough) and May 29, 1922 (one male, A. W. Richardson), No. 555, in the Canadian National Col-

lection, Ottawa; the male of May 29 the type, and a female of May 23 the allotype. The types are at Ottawa, and some of the specimens above enumerated have been given by Dr. McDunnough to Drs. Walker and Howe and myself. At the suggestion of Dr. McDunnough, I take pleasure in naming this Canadian dragonfly for Dr. James Fletcher, "first Dominion Entomologist, who was a keen collector in all orders" and whose work is comparable with that of Dr. Lintner, for whom the species from the United States is named.

Fletcheri is a darker, denser veined species than *lintneri*, from which it is separated at once by the dark face and frons and the reduction or absence of pale apical markings on segments 2—9. In a letter Dr. McDunnough says. "This species is one of the earliest to occur in our locality and nearly all the specimens I took were more or less teneral and were taken in a small spruce grove close to a sphagnum bog, which contained several open pools of water, in which, I presume, the nymph lived. They seem to be fond of sitting on the trunks of the spruce trees, darting out from time to time to capture mosquitoes and other insects. When fully mature they are very difficult to catch, owing to their small size and the rough nature of the locality they frequent."

In addition to the venational characters hitherto used in defining this genus, the following characters may now be added: Tibial keel lacking in the female and on the midtibia of the male; on the fore tibia of the male the keel is about half the length of the tibia, and on the hind tibia it is equal to about two-thirds the length. Accessory genitalia of the male prominent, genital lobes oblong, hamules reaching to or beyond the apex of the genital lobes, scimitar-shaped with a curved indentation on the ventral border near mid-length; male superior abdominal appendages about as long as segment 8, shorter than 9 and 10 combined, roughly cylindrical, flattened basally with an externo-ventral toothed angle at about two-fifths the length, this angle followed by a row of seven to nine teeth, reaching the subapex, irregularly spaced and not uniform in size; inferior appendage triangular in shape, apex narrowly truncate, the length exceeding the width by one-fifth or slightly more, about two-thirds as long as the superiors. Vulvar lamina a large rounded triangular or oblong plate, nearly as long as or longer than segment 9 in the middorsal line, narrowly divided for more than half its length.

TWO NEW RACES OF THE GENUS PLEBEIUS LINN. FROM BRITISH COLUMBIA

BY E. H. BLACKMORE,
Victoria, B. C.

In a paper entitled "The Lycæninæ of British Columbia" (Proc. B. C. Ent. Soc., March, 1919, No. 14) the writer described a new race of *Plebeius saepiolus* Bdv. under the name of *insulanus*. In that paper I omitted to designate a type, but will do so now and append a more detailed description of this new race.

Plebeius saepiolus insulanus new race

Male. Upper side, bright silvery blue with a blackish border on outer margin, 1½ mm. wide on primaries, somewhat narrower on secondaries; fringes, basal third blackish, outer two-thirds white on outer margins, inner margins all

white. Underside both wings bluish-white sprinkled with green scales basally; subterminal row of spots on primaries are somewhat reduced, being rounder and not so elongate as in typical *sacpiolus*, also in some specimens they have a tendency to become obsolete; on secondaries the subterminal spots are also round instead of being more or less triangular.

Female. Upper side, deep brown, with a narrow, somewhat indistinct black discal mark; secondaries with a few scattered bluish scales basally, on some specimens a trace of a reddish brown spot near anal angle. Fringes same as male. Underside similar to that of the ♂ excepting that the ground colour is darker, in some specimens deepening to brownish white.

The chief points of difference between this new race and typical *sacpiolus* may be summed up as follows:—On the upper side in the ♂ the blue is much brighter and does not have the same light violaceous sheen as *sacpiolus*, on the under-side the ground colour is a clear bluish white, not greyish white like the typical form.

In the female the colour of the upper side is an even dark brown with a few scattered blue scales basally, whereas typical *sacpiolus* is heavily shot with blue on the basal half of both primaries and secondaries. Alar expanse 26—29 mm.

Described from 20 specimens, 10 ♂ ♂ and 10 ♀ ♀ taken by the writer at Victoria, B. C., and Goldstream, B. C.

Holotype—♂, Victoria, B. C., May 24th, 1916, in the Canadian National Collection at Ottawa.

Allotype—♀, Victoria, B. C., June 14th, 1916, in collection of author.

Paratypes—6 ♂ ♂ and 8 ♀ ♀, Victoria, B. C., May 22nd to June 24th; 3 ♂ ♂ and 1 ♀, Goldstream, B. C., May 30th to June 18th, in author's collection.

Paratypes will be distributed amongst the following institutions:—Canadian National Collection, Ottawa; U. S. National Museum, Washington, D. C.; Provincial Museum of Natural History, Victoria, B. C.; and the collection of Dr. Wm. Barnes.

Plebeius icariodes montis new race

Male. Upper side, pale violaceous blue with a narrow, black border (about 1 mm.) to outer margin of both wings; a short, narrow, black discal mark; fringes, on outer margins of both wings, basal half blackish, outer half white, inner margins all white. Underside of both wings pale greyish white; primaries with discal dash and post-median row of black spots heavily marked as in typical *icarioides*; subterminal spots much reduced, tending to become obsolete anteriorly; secondaries with a white lunate discal mark and a post-median row of white spots centered with a minute black dot excepting the first spot nearest costal margin, which contains a large, black dot; subterminal row of black spots faintly indicated; fringes white.

Female. Upper side deep brown, but not nearly so dark as in race *blackmorei* B. & McD,, basal half of primaries shot with violaceous blue; secondaries with a few blue scales at base and along inner margin; a subterminal indefinite line of bluish scales on outer margin, which breaks up to form a row of irregular lunules of the ground colour. Underside similar to that of the ♂, including the ground colour, which is rather unusual, as the underside of the females in

this genus is generally much darker than that of the males. Alar expanse 29 mm.

Described from 8 specimens, 6 ♂ ♂ and 2 ♀ ♀ from Mt. McLean, Mt. Cheam and the Hope Mts.

Holotype—♂, Mt. McLean, near Lillooet, B. C., (A. W. Hanham), July 15th, 1919, in Canadian National Collection, Ottawa, by the kind permission of the collector.

Allotype—♀, Mt. McLean (7,000 ft.) B. C., (A. W. Hanham), August 21st, 1920, in collection of author through the kindness of the collector.

Paratypes—3 ♂ ♂ and 1 ♀, Mt. McLean, B. C. (A. W. Hanham) July 14th, 1919 and August 21st, 1920; 1 ♂ Mt. Cheam, nr. Agassiz, B. C., August 7th, 1908; and 1 ♂, Hope Mts., B. C., (R. V. Harvey) July 17th, 1906, in the Hanham collection and that of the author. A male paratype will be sent to the U. S. National Museum and one to the Provincial Museum, Victoria, B. C.

This new race is evidently a high altitude form, and seems quite distinct. The specimens from Mt. Cheam and the Hope Mts. I have had separated for some years, and when I received Mr. Hanham's specimens from Mt. McLean, I became convinced that it was a good geographical race.

In the ♂ it differs on the upper side from *icarioides* Bdv. and *pembina* Edw. in the much lighter shade of violaceous blue and also in the much narrower black border; from *blackmorei* B. & McD. in the totally different shade of blue, the latter race being of a silvery blue; on the underside it differs in the much lighter ground colour from *icarioides* and *pembina*; in the spotting of the primaries it is not so heavy as either of the above-mentioned, but is much heavier than *blackmorei*. On the secondaries the black centres to the white spots are a little more distinct than in *blackmorei* while the large black centre to the anterior white spot of the post-median band seems quite distinctive. In fact, it seems a form that is midway between *pembina* on the one hand and *blackmorei* on the other, although the differentiating characters are apparently quite constant.

NOTICE

The attention of Entomologists throughout the world is called to the fact that, beginning with the Volume for 1922, the preparation of the "Insecta" part of the "Zoological Record," is being undertaken by the Imperial Bureau of Entomology. In order that the Record may be as complete as it is possible to make it, all authors of entomological papers, especially of systematic ones, are requested to send separata of their papers to the Bureau. These are particularly desired in cases where the original journal is one that is not primarily devoted to entomology. All separata should be addressed to:

The Assistant Director, Imperial Bureau of Entomology, 41, Queen's Gate, London, S.W.7, England.

Mailed Thursday, May 10th, 1923

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POPULAR AND PRACTICAL ENTOMOLOGY

The Alfalfa Thrips and Its Effect on Alfalfa Seed Production*

BY H. L. SEAMANS,
Ottawa, Ont.

The Province of Alberta has the largest consolidated acreage of alfalfa in Canada and is rapidly increasing this acreage as new irrigation projects are opened. In spite of this, very little alfalfa seed is grown and new plantings are dependent upon imported seed. Attempts to promote the growing of alfalfa seed as an industry have met with poor success thus far, owing largely to the fact that it has been almost impossible to raise a paying crop of seed. Some growers have succeeded in getting profitable yields, but these cases are not at all general.

There are several factors which govern the production of seed concerning which more study is needed. These are largely problems of culture and methods of tripping the blossoms and have little to do with this paper, which deals with the influence of thrips on seed production.

Reports of poor blossom production and the early dropping of blossoms where alfalfa has been left to produce seed, have often been accompanied by specimens of thrips.

The examination of a long series of thrips collected from alfalfa in Alberta shows that the most prevalent species is *Frankliniella occidentalis* Pergande. This species is often confused with, and is probably closely related to, *F. tritici*, which has been reported as being found on alfalfa, but has never been associated with any particular extensive damage. During the later part of the summer, another species, *Haplothrips statices* Hal., is present, but not in serious numbers.

Both *F. tritici* and *occidentalis* are reported in literature as being common flower-thrips infesting fruit blossoms, and as being injurious to strawberries. They have also been recorded from cotton, but not in injurious numbers. It is evident that the distribution is general over the entire North American continent, and it may be more of a pest than is generally supposed. Owing to their small size, thrips are not always recognized by the average farmer as a potential pest. At Lethbridge, Alberta, specimens of *F. occidentalis* have been taken from blossoms of all the common weeds and flowering plants.

In 1915, Borden, in the Journal of Economic Entomology, Vol. 8, page 354, reports having found *F. tritici* in alfalfa blossoms feeding on the young floral parts, and causing the blossoms to drop prematurely without setting seed. Essig, in Bulletin 2, of the California Horticultural Commission, lists alfalfa as one of the host plants of this species of thrips, but does not record any damage. Cooley, in the 18th Report of the State Entomologist of Montana (1920), reports an unidentified species of thrips as being so plentiful in the Yellowstone Valley that it destroyed the blossoms of alfalfa and caused a 75 per cent. loss of the

*—Contribution from the Division of Field Crop and Garden Insects, Entomological Branch, Dept. of Agric., Ottawa Ont.

honey crop. Mr. R. C. Treherne, Entomological Branch, Ottawa, has since identified these specimens as *Frankliniella occidentalis* Pergande.

The adult insect is very minute, about 1 mm. in length, dark brown in color, and difficult to find in the field. The handling of stalks and blossoms causes the insects to hide or drop to the ground, and only hurried glimpses of them are caught as they run across a leaf or flower petal. If stalks of alfalfa are shaken over the hand or a piece of white paper, the insects will drop thereon and in this way may be easily distinguished and their movements can be readily observed. When very plentiful hundreds of them may be shaken out of a single handful of alfalfa stalks.

The adult thrips emerge from hibernation at Lethbridge, Alberta, when the alfalfa is about six inches high, soon after the first week in May. None of the immature stages are found at this time, but towards the last week in May eggs can be located in the stems, leaves and stipules. At this time the adults have practically disappeared over the entire field.

The eggs are very minute, whitish, cylindrical, and slightly curved or kidney shaped. They are laid inside the plant tissues and as tiny translucent bodies can be readily seen in the leaves and stipules. It is more difficult to find them in the stems of the plant as they are almost completely buried. Within three to five days after the eggs are laid they begin to swell and change color. As the swelling increases the eggs are forced partly out of the tissues in which they were deposited, the color becomes more yellow and the red eyes of the larval thrips are clearly visible through the chorion.

The eggs hatch in from six to nine days, depending on the weather conditions. The minute young thrips are yellow with red eyes, and remain for the most part in such places as unopened buds or at the base of the corolla tube of an open flower. The larval period is very variable and adults begin to appear in from six days to two weeks. All succeeding generations are so intermingled as to be almost inseparable; adults of two generations being present at the same time during the greater part of the summer.

From the time the first eggs appear in May until the first adults are found in June between two and three weeks elapse, depending upon the climatic conditions. As the weather becomes warmer and more settled it is probable that a generation can be completed in less than two weeks. The number of generations per season would necessarily vary with the time interval elapsing between the last frost in the spring and the first frost in the fall. There has been an average of seven generations during the past two seasons.

The seed production in alfalfa is materially reduced by thrips in two ways. The most severe losses are caused by the great decrease in blossom production due to the thrips feeding on unopened buds, while lesser losses are caused by the thrips feeding on the ovaries of the opened flowers or on the young seed pods. Experiments have been conducted to determine as nearly as possible the amount of damage that was due directly to thrips, both in the reduction of blossoms, and in the loss of seed after the blossoms had opened.

The younger stages of thrips feed in very protected places, and above all seem to prefer the minute flower buds while the entire spikelet is inside the general bud sheath. This causes the buds to die, and when the sheath opens

the buds are white or "blasted." As growth continues the spikelet stem grows bearing the dead buds, which soon drop off, leaving a bare stalk. This is the most serious form of damage, and actual counts have shown that as the thrips increased in numbers, after the middle of June, the percentages of blasted buds increased until by August over 80 per cent. of the buds produced were blasted. Stalks of alfalfa confined in thrips-tight cages, with and without thrips, showed that the "blasting" of the buds only occurred when thrips were present. The same conclusions were reached after a series of observations carried over two years through a great number of fields containing all degrees of thrips infestation.

Fig. 1.—Alfalfa Stalks of the same age showing the effects of Thrips on blossom production. The stalk on the left is from "clipped" alfalfa, the one on the right from the unclipped plot. Note the "blasted" buds and bare flower stems.

After the buds have grown out of the sheath they are reasonably free from thrips damage until they begin to open. All stages of thrips may be found inside of the open blossoms, but the adults are generally the more numerous. The greatest damage at this time is caused by the thrips feeding on the ovaries of the flower. This may be extensive enough to destroy the entire flower or it may only destroy part of the ovaries, allowing the pod to continue development with a reduced number of seeds. Caged blossoms which were tripped artificially, but which contained thrips, were so badly injured in 1922 that only 60 per cent. set seed with an average of 3.4 seeds per pod, while thrips-free blossoms under the same conditions resulted in a 100 per cent. seed setting with an average of 6 seeds per pod.

The tendency of all stages of the insect to spend most of the time in some well protected place about the plant, reacts against the use of contact

dust and sprays as control measures. Experiments with the eggs show that they dry up within a few hours after the stem in which they have been deposited is cut. Since the eggs are deposited by the first generation adults at about the same time of year, and followed by the disappearance of the adult, cutting the alfalfa at this time was tried as a control measure.

Two years of experiments in early cutting or "clipping" as it is generally called, have given results which warrant this method being used in seed-producing areas. The following average results have been prepared from actual counts during the past two years. It might be stated that the general tripping of blossoms from natural causes during 1922 was much lower than in 1921, so that the seed crop was lower in spite of a greater blossom production.

	% Blossoms matured	Av. Seeds per pod	% shrivelled or deformed seed	No. of healthy seed per 100 blossoms
Uncut alfalfa	40.9	3	53	57.67
Cut alfalfa	73.6	4.2	14	265.84

This table shows that the clipping was responsible for producing over four times as much seed as was produced on the uncut alfalfa. In addition a light hay crop was secured which would average from 800 to 1,000 pounds per acre at a time when the hay supply on the ordinary farm is about exhausted.

Examination of the clipped field revealed very few thrips present before July 15, even though the clipping was done at the last of May, and despite the fact that the field was bordered on two sides by alfalfa which was not cut early. Both the uncut areas were heavily infested with thrips, but the prevailing winds blew over these fields from the clipped field, reducing any reinfestation from this source to a minimum. It was not until late in August that the infestation in the various areas was at all equal. This late in the season the buds cannot possibly mature seed so that any thrips injury would not affect the seed crop, as the ripening seed is too far advanced to be injured.

Frequent examination of the alfalfa after it is six inches high gives the best clue as to when to cut. A handful of alfalfa stalks should be gathered every two or three days and shaken over a piece of white paper. The thrips will be found to increase in numbers after they first appear, and then to suddenly drop off until there are only a very few to the handful of stems. This will usually happen towards the last week in May, and then the alfalfa should be cut as low as possible and used for hay. The subsequent growth with proper moisture conditions will be very rapid, and the majority of the buds which will have time to mature seed will grow out of the bud sheaths before the thrips are plentiful enough to cause any appreciable harm. In some of the alfalfa seed-producing sections of Montana, the farmers have stated that it is their practice to cut alfalfa grown for seed at the end of May. Their reason for this was that it seemed to cause a heavier blossom production and as a result the seed yield was much higher and of better quality.

Only one insect has been found associated with the thrips in alfalfa which might be parasitic. This is a very minute Chalcid which has been determined by Mr. R. B. Gahan, of the U. S. Bureau of Entomology as *Thripoctenus americensis* Gir.

There are two predators which are common. One of these is a small Anthocorid which is plentiful and has been observed in all stages feeding on thrips. It has been determined as *Triphleps tristicolor* Wlsh. by C. H. Curran, of the Entomological Branch, Ottawa. The other predator is a large black and white thrips, almost twice as large as *F. occidentalis*. Mr. R. C. Treherne has determined this species as *Aeolothrips fasciatus* Linn, a species which is commonly predaceous on various stages of thrips, and upon minute insect eggs in general.

A NEW VARIETY OF MELANOPHILA DRUMMONDI KBY. (BUPRESTIDAE, COLEOPTERA)

BY A. B. CHAMPLAIN AND J. N. KNULL,
Bureau of Plant Industry, Harrisburg, Pa.

During the summer of 1922, specimens of a bright green *Melanophila* were collected in Canada. The specimens were so strikingly different in habits and general appearance from the specimens of *Melanophila drummondi* Kby., which were taken in the same localities, and to which the species is most closely related, that the authors decided to give it a name.

Specimens were sent to Prof. H. C. Fall, who stated that he had two examples which were part of a series taken by the late Frederick Blanchard in the White Mountains of New Hampshire.

Melanophila drummondi var. *abies* n. var. Form and size of *Melanophila drummondi* Kby., bright green, more shining below than above. Head coarsely punctured, strigose on vertex. Prothorax wider than long, narrowed at apex and at base, sides slightly sinuate, disk convex, impressed each side, also a slight median impression, surface crenulate at the sides, transversely strigose in the middle, with an irregular smooth median callus, lateral margin obliterated in front, but well marked posteriorly. Elytra widest back of middle, sides arcuate from base to obtusely rounded apices, lateral margin faintly serrulate near the apices, surface granulate punctate, with three rather indistinct costae on each elytron, sparsely pubescent, three spots on each elytron arranged as in *M. drummondi* Kby. Abdomen sparsely punctate. Length 9.5 mm.

Male. Last abdominal segment broadly emarginate.

Female. Last abdominal segment rounded.

This variety is closely related to *M. drummondi* Kby., but can be separated from this species by the sculpture of the prothorax and by the color.

Described from a series of adults collected on the trunks of dying balsam (*Abies balsamea*) at Lake Opasatika, western Quebec, June 1 to June 3, and at Bathurst, New Brunswick, June 24 to July 20, by J. N. Knull. The species undoubtedly breeds in balsam.

Type. A male, No. 543, in the Canadian National Collection at Ottawa, paratypes in the same collection, in the collection of the Bureau of Plant Industry at Harrisburg, the U. S. National Museum, the collection of Prof. H. C. Fall, and the authors' collection.

AGRILUS BILINEATUS VAR. CARPINI, NEW NAME

I propose this name for the variety *azureus* described by me in Canadian Entomologist, Vol. 54, p. 84. According to Doctor Obenberger, the latter name was given to a South American species by Kerremans. J. N. Knull.

NEW LIFE HISTORIES, SPECIES AND VARIETIES IN PAPAIPEMA (LEPIDOPTERA) No. 22.

BY HENRY BIRD,

Rye, N. Y.

To the already rich aggregation of *Papaipema* species which flourish in the Chicago region of Illinois, another addition is to be recorded, and an interesting one, for its larva departs from the conventional type and affords a new outlook on the ontogeny of the group.

A commingling of the floral types of the Chicago Plain, those persistent prairie species that once must have largely dominated the state, together with those which prevail in similar latitude eastward, has been productive of a wide list of food plants eligible to these borers. Keen to take advantage of the opportunity, the coterie of local lepidopterists have rounded out a list of species quite in excess of that for any other locality in the country. *Cerina*, one of the old Grote species and originally described from Maine, occurs at Chicago, but here as elsewhere, the acquaintance with its larva suggested that the preferred foodplant for this species is likely yet an unsolved problem. A widespread floral survey for enlightment in this direction resulted in an unexpected disclosure.

To the clever field work of Mr. Emil Beer the discovery and proving of this distinct species is due. Since 1917 he has yearly been striving to gain the familiarity whereby a convincing series might be forthcoming, for his asociates and the writer included, considered his find to be merely an instance where a *necopina* larva had straggled to some other plant than its usually preferred Helianthus. During four years he received scant encouragement with his search for larvae, emphasizing the difficulty of running down one that works so astutely, as well as the handicap fire plays in their extermination. While the foodplant involved, *Lacinaria pycnostachya*, is one of the once common prairie species, it was not until 1922 that favorable stations were found where the larvae were working in numbers. Some of these forwarded to the writer, proved at once that a larva very different from any of the known congeners had thus come to notice, no matter how close its adult may simulate another.

As pupation occurs in the foodplant this extends the period for nearly a month when specimens may be secured, and ultimately an extensive series is reared. It develops that a white marked variation occurs along with the more prevalent concolorous form, similarly as with *nebris, nitela, frigida, thalictri* and others. Very generously, the material and notes have been handed to the writer for descriptive and comparative treatment. Justifiably, and because of other similar contributions on the part of Mr. Beer, it is fitting to dedicate this disclosure to him.

Papaipema beeriana sp. nov.

Head smooth on frons, antenna simple in both sexes and not set in an encircling tuft of white scales; thoracic vestiture matches primaries, the abdominal matches secondaries; the thoracic crest conical or truncate, not spreading; abdominal crests inconspicuous. Primaries produced at apex, of an even shade of smoky brown thickly sprinkled with white-tipped, and less so with bronzy, scales, while outwardly past the postmedial line a dull purplish sheen appears.

The markings are nearly obsolete, the postmedial line alone vaguely discernible, curves outward past reniform, then oblique to inner margin; the reniform is usually indicated as a darker area because of the omission of white powderings; or, the grey scales may outline the reniform; or the usual central line may alone be dimly indicated by greyish scales. There are no white dots on the costal vein. Secondaries dark, of an even smoky brown. Fringes are concolorous and glistening. Underneath the wings are of similar tone, with the whitish powderings equally abundant on the secondaries.

Expanse, 36 to 41 mm.

The male genitalia is of the typical generic pattern; the spinulated, trigonate tip of clasp is prolonged in line of axis; the harpe is the usual stout, curved prong, toothed posteriorly, and matches *necopina* closely.

A male type (holotype) from an observed larva is in the collection of the author and a considerable series of paratypes have been mostly returned to Mr. Beer, who will distribute them to the U. S. Nat. Museum and other important collections.

Type locality: The immediate environs of Chicago, Ill.

Little variation occurs in a series of forty bred specimens, either in size or coloration, and doubtless the species will be found very generally through the main range of the foodplant which Britton and Brown give as: "On prairies, Indiana to Minnesota, Nebraska, Kentucky, Louisiana and Texas."

For the white spotted form, as suggestive of the foodplant, we propose the name

Papaipema beeriana lacinariae form nov.

Similar to the typical form in every respect except that the stigmata stand out conspicuously marked in white. The round white orbicular and double spotted claviform are in linear alignment; the reniform is the usual collection of white spots surrounding a brown lunulate line, with the central outward spot distinctly yellow.

Expanse and other features the same as type form.

A male type (holotype) from an observed larva is with the author, and seven examples for Mr. Beer and others are labelled paratypes.

It would appear from these breedings that *lacinariae* may occur in a ratio of about 12 per cent. Its spots are similar to those of *nebris* which it resembles closely, though much darker.

Typical *beeriana* is similar to *necopina* and *aerata*, less so to *maritima*, *silphii*, *duplicata* or *nitela*. The variety *lacinariae* agrees in a way with *limpida* also, and it is possible the two may prove identical upon fuller information. Guenée described *limpida* as having white or whitish secondaries—the Lacinaria feeder has them smoky brown. With *aerata*, the term "whitish" applies. Hampson* puts *aerata* with *limpida*, retaining the Lyman name for the concolorous form, and with *limpida* types before him we trust to his verdict. Positively *beeriana* is distinct from *aerata*. If Hampson has erred and Guenée's *limpida* proves identical with *beeriana*, the latter term should be retained as representative of the concolorous form of *limpida*, in which case *aerata* Lyman would be of full specific rank.

*—Catalogue Lepidoptera Phalaenae Brit. Mus. Vol. IX, p. 85.

Two larval instars were under observation.

Penultimate stage: Larva is constricted with sutures pronounced, segments seem correspondingly shorter as compared with the average cylindrical type, with the last joint much and abruptly reduced. Head normal, full, rounded, suture inconspicuous, concolorous, shining brownish yellow, mouth parts and ocelli darkened; width 2.9 mm. Body shows skin of thoracic segments a little puckered as though not fully distended, the abdominal joints smooth and distended; color is a livid pink, lighter on thoracic joints where a whitish translucence shows at the sutures. This larva is unique in that there is no trace of the usual longitudinal lines, though it is possible they may show at an early stage. Cervical shield as wide as head, of similar shining texture, laterally edged with a brown marking. The tubercles stand out strongly like minute blackish beads, in full complement, as, ventrally on joint five, VII has two minute plates confluent which bear setae, also a third bearing a hair, slightly removed. Few of the congeners exhibit such detail. The unstable character of IV on joint ten is evidenced in the inflate at hand which shows this plate above on one side, and below the line of the spiracle, on the other side of the body. Anal joint much reduced, with roughened blackish plate. Length 30 mm.

Mature Larva: Generally similar but color paler; a robust larva recalling the European *Xanthoecia flavago*, rather than cylindrical *Papaipema*. Head darker; width 3.1 mm. Shield with side marking lost; tubercles much paler and apparently reduced; on joint five VII and its associates are reduced to mere points but all bear minute setae, half the length of the seta on VI. On joint ten, IV is below the spiracle, the latter in all instances black and are exceeded in size slightly by the principal tubercle plates. Length 42 mm.

Maturity is reached July 25 to Aug. 10, and there is the usual prepupal period of quiescence of about a week.

The pupa is the normal type; rather robust, for there is ample space in its cell-like burrow. The position of the tubercles can be discerned on most of the abdominal segments. The variety *lacinariae* can be foretold as the white stigmata show plainly when the moth is near emergence. The cremaster is two stout spines, slightly diverging. Length 24 to 26 mm.; width 7 mm. Emergence September 3 to 27.

Parasitism in 1922 seemed slight, *Amblyteles lactus* (Brulle) being parasitic in the pupal stage, as it is with a majority of the species which pupate in their burrows. *Lactus* emerges from *Papaipema* hosts during September and these adults hibernate and presumably have an alternative host in the early part of the following season.

The life cycle for *beeriana*, so far as observed, accords fully with the congeners. The egg unquestionably carries over winter, and emergence is, as with the allies, in the last week of May, for the earlier examples. In 1921, Mr. Beer became doubly satisfied of the individuality of his discovery as then the appearance of the *lacinariae* variety dispelled all question of *necopina* relationship, and the assistance of Mr. A. K. Wyatt in 1922, helped in a final round-up of numbers. Their notes and observations deal with the larval period from June 11 onward: "The larva are hard to locate after having worked down to the root, no frass appearing, and the plant does not show evidence by wilting. An

irregular hollow is made in the root and much of the frass is left therein, making it very unclean when moist. One root clump may harbor several individuals, five pupae occurring in one instance in an isolated case. Where the plant was numerous, by using a spade, twenty-one pupae were found in an hour. On September 17, 1922, in getting twenty-two pupae at another station, many were noted to have already emerged."

The larval habit is similar to *P. duplicata* in that a cell-like chamber is formed under the epidermis of the bulky, leathery root, and there is the same inactive or lethargic attitude whereby a larva clings to its habitation even though partly demolished, or shows little inclination to move. *Lacinaria pycnostachya* differs from its eastern allies in having a sturdy root-system suitable for withstanding the vicissitudes of a prairie habitat. It was doubtless very abundant before the primitive prairie was disturbed, and from what we see of *beeriana*, the moth likely occurred in greater numbers in those times. That it keeps to its particular foodplant seems probable, for the extensive work done locally among these borers, has not revealed it from other plants. It is worthy of note that *necopina* has been reared from this plant, but it was identified as such even in the larval form from the dorsal stripe and other characters.

In demonstrating again how close the moths of this genus may come superficially, Mr. Beer's discovery is a fitting reward of persistent research.

ZARRHIPIS LE CONTE (COLEOPTERA)

BY H. C. FALL,

Tyngsboro, Mass.

The members of this genus take the place on the Pacific Coast of the *Phengodes* of the Atlantic region. Their rather large size, contrasting colors, and the beautifully plumose antennae of the males render them very conspicuous insects, and their scarcity is great enough to make them highly prized by all coleopterists. The females are, I believe, larviform, and are still rarer in collections.

Twenty years ago and more, in the days when the little work room of Chas. Fuchs on Kearney street, San Francisco, was the rendezvous of all resident and visiting coleopterists, some one one day brought in a jar of earth containing one or more of the big, luminous larvae (or females) of what we took to be a species of *Zarrhipis*, but whether the actual identity of these was ever established, I do not now recall.

For nearly thirty years there has stood in my cabinet a very distinct undescribed species of *Zarrhipis*, taken while on a collecting trip to the western borders of the Colorado Desert.. It is high time this rarity was given a name.

When Horn described Z. *riversi* in 1885 he remarked that the superficial characters separating the four species which he tabulated seemed very constant. Assuming that he was correct, there are in my collection several other forms equally deserving of specific names. It is quite possible that increased experience, aided by breeding from the egg, if that ever shall become possible, will ultimately change our conception as to what constitute specific characters in this genus, but that is a problem for the future.

Z. truncaticeps new species

Head and elytra piceous black, sides of metasternum and last two abdom-

segments black. Last joint of maxillary palpi piceous, elongate triangular, twice as long as wide, the apical edge shorter than the inner. Prothorax about inal segments dusky; palpi, base of antennae, thorax, body beneath and legs, yellow. Terminal joint of maxillary palpi slender, the apical edge only slightly oblique. Eyes very large and prominent; head abruptly constricted behind the eyes. Epistoma declivous and subcontinuous with the labrum. Prothorax nearly two-thirds as long as wide, sides moderately reflexed, surface almost absolutely smooth, not pubescent in the type. Elytra four times as long as the thorax, dehiscent, feebly, finely punctate, smoother than usual in the genus. Third tarsal joint not distinctly lobed. Length to tip of elytra (head and thorax deflexed) 11 mm.

Palm Springs, California, April 11, 1893.

By its abruptly constricted head, virtually non-lobed third tarsal joint, and distinctly dehiscent elytra, this species leans palpably toward *Phengodes*; the head, however, is not deeply excavated, and the elytra, though shorter and more divergent than in the other species of *Zarrhipis,* are much less so than in *Phengodes.*

Z. amictus new species

Rufotestaceous; antennae, except at base, and elytra, black. Last joint of maxillary palpi not very slender, the apex strongly oblique and nearly equal in length to the inner side. Eyes rather less prominent than usual, their longest diameter much less than half the width of the front. Head distinctly punctate; prothorax three-fifths as long as wide, sides rather narrowly margined, surface finely but quite evidently punctulate. Elytra somewhat crumpled but apparently of about the usual length, moderately scabrous. Length 10 mm.

California, Butte Co. Collected by F. W. Nunenmacher.

The characteristic features of this species are the comparatively stout terminal joint of the maxillary palpi, relatively small eyes, more distinctly punctate head and thorax, and the entirely yellow abdomen, agreeing in this last respect only with *integripennis*; the latter a larger species with more transverse and much more widely margined thorax, and more slender piceous terminal joint of palpi, the head also more rapidly narrowed to the neck.

Z. brevicollis new species

Rufotestaceous, antennae except at base, head, and last two abdominal segments, black. Antennal joints more slender, the rami conspicuously longer than in the preceding species. Last joint of maxillary palpi slender, fully three times as long as wide. Eyes very prominent; head rapidly obliquely narrowed to the neck. Prothorax twice as wide as long, very broadly margined and very minutely remotely punctulate. Elytra six times as long as the prothorax, finely punctate, and feebly scabrous. Length 12.5 to 16 mm. to the elytral apex.

The type of this species was taken at Loma Linda, Southern California, March 17, by G. H. Pilate. Other examples are from Claremont (Baker) and San Diego (Ricksecker). Two others, from Pasadena and Redondo differ in having the head rufotestaceous like the thorax, but seem otherwise identical.

Z. alamedae new species

Rufotestaceous; antennae except at base, and seventh and eighth abdominal

four-sevenths as long as wide, sides moderately margined. Elytra about four and one-half times as long as the thorax, more strongly scabrous than in any of the preceding species. Length (to elytral apex) 9.5 to 12 mm.

Alameda Co., California. Two examples; a third in the collection of Mr. C. A Frost.

This species is probably most closely related to *riversi*, the type of which I have not seen. The chief distinguishing characters of the latter as given in the following table are taken from Horn's description.

Table of Species.

1. Head behind the eyes abruptly transversely constricted; third joint of tarsi not distinctly lobed; epistoma declivous, scarcely elevated above the labrum ..... *truncaticeps.*
   Head behind the eyes more or less obliquely narrowed to the neck; third and fourth joints of tarsi lobed beneath; epistoma elevated above the labrum ..... 2.
2. Body beneath entirely flavo- or rufotestaceous ..... 3.
   Body beneath rufous, seventh and eighth abdominal segments black or piceous ..... 4.
   Body beneath, except of prothorax, black or piceous ..... 5.
3. Apical edge of last joint of maxillary palpi not very strongly oblique and much shorter than the inner edge; prothorax shorter and more widely margined ..... *integripennis.*
   Apical edge of last joint of maxillary palpi strongly oblique and subequal in length to the inner side; eyes smaller ..... *amictus.*
4. Head typically entirely or in great part black (see remarks under description of *brevicollis*); maxillary palpi entirely yellow, terminal joint as long as the preceding, only slightly dilated apically, the apex feebly oblique ..... *brevicollis.*
   Head piceous, middle of the front and the clypeus reddish yellow; terminal joint of maxillary palpi piceous, triangular and shorter than the preceding joint ..... *riversi.*
   Head rufotestaceous, terminal joint of maxillary palpi piceous, fully as long as the preceding joint, apical edge shorter than the inner .. *alamedae.*
5. Head, palpi and legs black or piceous; thorax very broadly margined; size large (13.5 mm.) ..... *ruficollis.*
   Head pale in front, palpi except terminal joint, and legs, pale; thorax narrowly margined; size much smaller (10 mm.) ..... *piciventris.*

In Horn's table and remarks on this genus (Trans. Am. Ent. Soc. XII, 1885, p. 148) there are two errors of statement. The palpi in *piciventris* are there said to be entirely piceous; they are in reality yellow with the last joint piceous. Moreover, the body beneath in *ruficollis* is as given in the table above, not rufous with tip of abdomen black, as stated by Horn.

Of all the species, the elytra are smoothest in *integripennis*, and are perhaps most strongly rugose or scabrous in *ruficollis*, though *piciventris*, *alamedae* and probably *riversi*, have the elytra nearly as rough. *Ruficollis* is most robust, the sides of the thorax broadly and steeply reflexed, the antennae blacker than

usual, the erect hairs of the antennal rami in most species being brownish fuscous; it is the only species with dark legs.

Riversi is known to me only from the description. There is a specimen bearing this name in the Le Conte collection, but as it does not agree in several particulars with Horn's diagnosis, I do not at present accept it as an exponent of the species.

In a considerable number of specimens examined the penis is more or less exposed. This organ is in all cases very slender and subcylindrical, feebly and gradually dilated apically, the dilated portion absolutely simple in *integripennis* and *piciventris*; excavated on one face (spatuliform) in *alamedae* and *brevicollis*, more feebly so in *truncaticeps* and in the specimen labeled *riversi* in the Le Conte Collection; not visible in *ruficollis* or *amictus*. Whether these differences will prove constant and characteristic it is not as yet possible to say.

Color characters have been used freely in the table because so easily apprehended; they have not, however, been relied upon solely in any single instance. I suspect that the infuscation of the head and abdominal apex, as well as of the terminal joint of the maxillary palpus will prove more or less inconstant, but even here it is impossible to speak with much assurance without a larger series of specimens than I at present command.

The types of the new species herein described are in the writer's collection.

FRAGMENTARY NOTES ON FOREST COLEOPTERA

BY A. B. CHAMPLAIN AND J. N. KNULL,

Bureau of Plant Industry, Harrisburg, Pa.

In a previous article[1], the authors presented notes on Coleoptera from rearings, field observations and collections, which were additions to the knowledge of certain species. The following collections of fragmentary notes of a similar nature from further rearings and observations were made by the authors, or by others to whom due credit is given, and are published with the permission of Prof. J. G. Sanders, Director of the Pennsylvania Bureau of Plant Industry.

LYMEXYLIDAE

Melittoma sericeum Harris. Apparent damage to chestnut beams supporting heavy articles in a storage house on the Mt. Gretna State Military Reservation was brought to the attention of Prof. J. G. Sanders. The writers, acting for the Bureau, visited the Reservation, and found that the timbers, cut from local woodlots, were heavily infested with this "Chestnut timber worm." Quantities of frass in small piles throughout the building caused by the continued working of the larvae of *Melittoma* in the beams made a problem that loomed large to the authorities. Our idea that the natural drying out of the timbers would cause the *Melittoma* larvae to die was borne out by subsequent observation. Samples taken into the laboratory quickly reacted to the dry conditions; for a short time dust piles were observed, soon they ceased altogether. Later report from the commandant at the military reservation corroborated our observation that no serious damage was done.

1—Miscellaneous Notes on Coleoptera, The Canadian Entomologist, Vol. LIV, p. 102. (1922).

Ostomidae

(*Temnochilidae, Trogositidae*)

This family of beetles approaches the Cleridæ[2] in their importance as beneficial insects. Especially the genus *Temnochila* (*Trogosita*), which is prevalent wherever *Dendroctonus* occurs. They are predaceous in both larval and adult stages. The larvae are able to enter the mines and galleries of destructive bark-beetles and feed upon the broods, including eggs, larvae, pupae and even newly transformed adults. Upon eradicating the brood of one parent they migrate to another gallery.

The adult Ostomids prey upon small insects that may be found on the outer bark and beneath the bark of trees that are or have been infested by bark-beetles.

Although they are not as active as adult Clerids and their activities are principally confined to their dark habitats, they may be found flying on warm, sunny days; at night the adults may be found on the outer bark of bark-beetle infested trees, mating, feeding or ovipositing.

Corticotomus caviceps (Fall). A common predator on the larvae of pin-hole borers and Calandrid beetles of the genera *Cossonus* and *Rhyncholus*. The adults of *C. caviceps* may be found in the galleries or mines of the pin-hole borers and Calandrids; their elongate, cylindrical form being especially adapted to these conditions. They hibernate as adults and may be found in this stage throughout the winter months, in pin-holes, beneath and inside the bark, near the base of dead conifers. In captivity the adults feed readily on Scolytid and other small larvae, and it is probable that the larvae of *C. caviceps* prey mainly upon the larvae of Calandrids, pin-hole borers and Scolytids. Colorado and Western U. S.

Corticotomus cylindricus (Lec.) Harrisburg, Pa. Reared from *Rhus toxicodendron* infested by Scolytids, H. B. Kirk, Wildwood Park, Harrisburg, Pa., April 27; adults found in mines and galleries of *Phthorophloeus frontalis* (Oliv.) in mulberry bark. Miami, Florida, April 14, adults taken in umbrella while beating pine.

Airora teres (Melsh.) Colorado. Comparatively rare, predaceous on Scolytids in conifers.

Airora cylindrica (Serv.) Harrisburg, Pa. Adults collected at night on hickory trees infested with *Scolytus quadrispinosus* Say; Kirk and Champlain.

Temnochila (*Trogosita*) *aerea* (Lec.) Arizona. A large species that is primarily a predator on borers in deciduous trees and plants. The larvae mining through the galleries and burrows of wood-borers.

Temnochila virescens (Fab.) Pennsylvania and Eastern United States. A predator on wood and bark-borers in coniferous trees, more especially Pinus. The adults prey upon small insects that occur on and beneath the bark, while the larvae enter the mines and galleries of wood and bark borers and feed upon the broods, eggs, pupae and newly transformed adults.

Temnochila virescens var. *chlorodia* (Mann). One of the most important predators on forest insects in the west. It is found wherever *Dendroctonus* occurs, the parent placing eggs in a tree during or soon after an attack by *Den-*

2—Larvae of North American Beetles of the Family Cleridae, by A. G. Boving and A. B. Champlain, Proc. U. S. Nat. Museum, Vol. 57, No. 2323.

droctonus. In Colorado during June and July the newly hatched larvae of *T. chlorodia* enter the galleries and mines and consume both eggs and larvae of bark-beetles. These predaceous larvae migrate from one brood to another in their search for food and continue to attack the *Dendroctonus* broods until the latter transform and emerge. It is possible according to observations that we have made that this insect requires several years to reach maturity, spending the second year of its larval existence in the *Dendroctonus* abandoned tree, feeding on the larvae of secondary wood borers.

The mature or prepupal larvae are found in cells in or beneath the bark, usually near the base of the tree. Here they often overwinter in a curled position. Specimens collected in this condition readily pupated indoors and transformed to adults.

Tenebrioides. There are a number of species in this genus that occur as predators on forest insects. In both deciduous and coniferous trees both larvae and adults may be found feeding on the larvae of wood and bark-borers; on the whole they are decidedly beneficial.

Tenebrioides bimaculatus (Melsh.) Pa., N. Y. Adults reared from larvae taken from mines and pupal cells of *Agrilus bilineatus* Web., in the outer bark of oak. The larvae were curled up in the cells with the remains of the Agrilus larvae.

Ostoma quadrilineata Melsh. Inglenook, Pa., May 17. Adults found in pupal cells of *Bellamira scolaris* Say in dead decaying *Betula nigra.* One adult to a cell.

Thymalus marginicollis Chev. Harrisburg, Pa. Adults reared from larvae found in dead, soft willow limbs.

Tenebrionidae

Hypophlocus. It has been the experience of the writers to find these beetles in trees that have been killed by bark-beetles. They are apparently not predaceous but rather are scavengers feeding on refuse in the bark-beetle galleries, mold and fungous growth.

Hypophlocus parallelus Melsh. Overwinters in the adult stage, beneath the bark and in old bark-beetle galleries and mines in coniferous trees. They may be found in small groups, apparently living in harmony with other hibernating species such as adults of *Aulonium longum* Lec., *Corticotomus caviceps* Fall, small Histerids, Staphylinids, Ips, etc. It is commonly found in trees from which bark-beetles have emerged from one to two years before, but is present in bark-beetle infested trees to some extent. The larvae are to be found in the same situation as the adults and are found during the summer months.

Our specimens are from Colorado, New Jersey and Pennsylvania. The eastern specimens are generally smaller and less robust, and may be different, although no characters were found on which to base this supposition. The eastern specimens were usually found in small numbers, often but one at a time, and are somewhat rare.

Hypophlocus cavus Lec. Occurs beneath the bark and in the galleries and mines of *Scolytus quadrispinosus* Say in hickory. The adults are active at night, running over the bark of trees that are attacked by *Scolytus* and also

those that have been abandoned by the bark-beetles. It undoubtedly acts as a scavenger in these situations. It is not rare at Harrisburg, Pa.

Hypophloeus tenuis Lec. Specimens from Ambler, Pa., May 11, and Monroe County, July 22. In both instances the adults were taken from the galleries of *Pityogenes hopkinsi* Swaine, in cut white pine branches.

Anobiidae

Habrobregmus carinatus (Say). Det. H. C. Fall. Pittston, Pa., June 5, 1922. Sent in to the Bureau by correspondent who states that they were breeding in and damaging timbers in his cellar.

Petalium bistriatum Say. Det. H. C. Fall. Harrisburg, Pa. Reared from dead sumac.

Bostrichidae

Scobicia bidentata (Horn). Inglenook, Pa. Breeds in dry, dead sassafras. Infests trees several inches in diameter that were attacked and killed by *Apteromechus ferratus* (Say). The saplings and seedlings are attacked after being killed by the work of *Oberea ruficollis* Fab. in the roots.

Dinoderus brevis (Horn). Det. H. C. Fall. Harrisburg, Pa. Breeding in a fancy workbasket made of bamboo (?) or reed. A cosmopolitan species.

Mylabridae

(*Bruchidae*)

Mylabris mimus Say. Hummelstown, Pa. Adults and pupae found in the seed of *Cercis canadensis*, December 17th. The larvae pupate in the fall and transform to the adult stage through the fall and winter. A few exit holes indicate that adults had emerged in the late fall.

Mylabris bivulneratus Horn. Camp Hill, Pa. Collected and reared from the seed of *Cassia medsgeri* by Salome Comstock of the Bureau of Plant Industry. It is recorded in the literature as breeding in the seeds of a related plant, *Cassia marilandica* L.

Platystomidae

Gonotropis gibbosus Lec. Inglenook, Pa., June 27, July 24. Adults collected on dead hemlock branch during successive years. Aylmer, Que., Aug. 12, adult collected.

Tropideres bimaculatus (Oliv.). Hummelstown, Pa., May 20. Adult collected resting on dead white oak.

Curculionidae

Otidocephalus scrobicollis Boh. Hummelstown, Pa., Feb. 26, 1922. Pupae and adults found in fallen dead branches of *Quercus alba*. The larvae had worked through the central part of the dead twigs. Adults occur during May.

Cryptorhynchus obtentus Herbst. Reared from dead, down, decaying limbs of *Betula lenta* from four different localities in the vicinity of Harrisburg, Pa. Adults collected June and July.

STUDIES IN CANADIAN DIPTERA

I. Revision Of The Asilid Genus Cyrtopogon And Allied Genera.

BY C. HOWARD CURRAN,
Ottawa, Ont.

(continued from page 95)

Eucyrtopogon comantis new species

Dorsum of thorax with conspicuous white mane anteriorly; arista about two-thirds as long as third antennal segment.

Length 11-12 mm. *Male.* Face moderately convex, thickly covered with white pollen, mystax chiefly black, but the silvery white hairs numerous so that it appears chiefly white except in the middle and below; front opaque black, the orbits thinly silvery pollinose; pile luteous, on the ocellar swelling black, tipped with white. Occiput with white pile, the occipital ciliae luteous, the pile in their vicinity more or less so; cheeks with black pile tipped with white. Antennae black, with a whitish bloom, more yellowish on the first two segments, the pile pallidly luteous, one or two long hairs below the second segment, brownish; third segment narrow, gradually tapering, the immediate base swollen; arista slender, its basal segment thicker than the median, short, the apical segment spinose.

Thorax with the ground color shining black; a broad, geminate, complete median longitudinal stripe, blackish, the median whitish line not always distinct; on either side and above the roots of the wing a whitish vittae; elsewhere on the dorsum and on the pleurae more or less thickly covered with olivaceous yellow or golden brownish pollen. On the middle line a conspicuous white mane on the anterior half, bordered laterally by long black hairs; long white hairs just before the scutellum, elsewhere on the dorsum, black, the bristles brownish, tipped with white; on the pleura white, on the epimeron luteous yellow, the hairs below white. Scutellum convex, thinly, velvety brownish yellow, with abundant fine white pile; bristles long, slender, black, becoming yellow, the ends silvery white.

Legs black, the tibiae chestnut, pile chiefly yellow on the base of the hairs, the ends silvery white, so that it appears mixed yellowish and white; bristles piceous or piceous reddish. Anterior tibiae internally, the posterior ones intero-posteriorly and their tarsal cushions bright brownish red.

Wings chiefly hyaline, the apical portion greyish villous; crossveins and bifurcation of third vein and furcation of fourth and fifth veins clouded with brown; costa with double row of abundant curved spinulose hairs.

Abdomen shining greenish black; on the disc with short yellow, laterally with rather abundant, fine white pile, the bases of the hairs rather tawny, so that the pile appears intermixed; on the basal two segments mostly white; on the sixth ventral segment dense, sharply limited apically, reddish or tawny basally, the ends of the hairs white, but some black hairs intermixed. On the sides of the first to sixth segments apically a small, sub-oval greyish sericeous spot.

Holotype—♂, Chilcotin, B. C., April 29, 1920, (E. R. Buckell); No. 565, in the Canadian National Collection, Ottawa.

Paratypes—♂, Vernon, B. C., Oct. 13, 1918, ♂, Vernon, B. C., Dec. 1, 1918, both collected by E. R. Buckell.

Eucyrtopogon albibarbus new species

Mystax and beard mostly whitish; thorax with a sub-median row of piceous bristles, within which the pile is white on anterior half; abdomen with seven pairs of greyish sericeous spots.

Length 10 mm. ♀. Face gently convex; evenly covered with greyish sericeous tomentum; pile, when viewed from above, almost all whitish, the bases of the hairs above the oral opening brown and tawny. Front sub-shining black, with some yellowish tomentum, condensed along the orbits. Pile yellowish, the long hairs brownish basally. Antennae black, the two first segments with thin yellowish bloom; third segment moderately narrow, evenly tapering to its apex; style slender, not quite as long as the third segment.

Thorax covered with tawny tomentum, the usual geminate stripes and spots brownish. Pile brown, tipped with white, a row of long bristles outside the geminate stripe, between which, on the anterior half, the pile is white. Pleura with pallid yellowish pile. Scutellum convex, with tawny bloom in some lights; pile white; bristles slender, brownish, their bases yellow.

Legs black; pile whitish, not very abundant, bristles yellowish, anterior inner surface of front and posterior inner surface of hind tibiae with tawny pile, that on the front ones paler. Hind coxae simple.

Wings hyaline, not at all villous, the crossveins and furcations with small clouds of luteous brownish.

Abdomen shining greenish black, slightly metallic, each segment on the posterior angles with a greyish sericeous spot, those on the fourth to sixth segments reaching forward to the anterior margins along the sides. (The abdomen has been wet, so that it is not possible to determine definitely whether the spot on the third segment reaches completely forward.) Pile pallidly yellow, longer laterally, not abundant.

Holotype—♀, Moose Jaw, Sask., (Geo. S. Johnston); No. 564, in the Canadian National Collection, Ottawa.

This species is most nearly related to *E. comantis,* but seems to be quite distinct. The absence of villi on the wings will distinguish it from any species known to me. The small spots on the wings are very similar to those found in *Comantella maculosus.*

Eucyrtopogon spinigera new species

Closely related to *E. diversipilosis,* but the ♀ genitalia bears 12 spines; the dorsum of the thorax with a complete white pilose border, the spines of the scutellum almost all white, their bases narrowly yellow.

Length 10.5 mm. *Female.* Face moderately convex; with greyish white tomentum except an oval brownish spot on each side above; pile black, tipped with white. Front with brownish tomentum greyish along the orbits, pile black and luteous intermixed, the hairs on the ocellar swelling tipped with yellow. Occiput white pilose, the ciliae piceous except apically. Antennae black, the first two segments with greyish yellowish bloom, and yellow hairs, one long, blackish hair beneath the second segment; third segment moderate in width, gradually tapering; arista about two-thirds as long as the third segment, moderately slender.

Thorax with tawny bloom; the geminate stripe sub-shining blackish brown, the median stripe rather wide, greyish yellow, a short stripe on either side behind the suture and a broader one before the scutellum shining blackish brown; an oval spot before the suture, a more roundish one behind and an elongate apical triangle, rusty brown; bordering all the brown spots the tomentum is silvery whitish in some reflections; on the pleura, except the mesopleura greyish white tomentose. Pile of the dorsum black, the margins and pleura with yellowish pile. Scutellum convex, yellow tomentose in some lights, white pilose and spinose, the spines yellow basally.

Legs black, tibiae reddish chestnut. Pile and bristles luteous, tipped with white, appearing chiefly whitish on anterior legs. Coxae simple.

Wings largely cinereous villous, the crossveins and furcations crouded with yellow brown.

Abdomen shining greenish black, with short, yellow hair on the disc, longer, yellow, but not abundant on the sides. On the posterior angles of each segment with a greyish white pruinose spot, all the spots wider laterally, that on the sixth segment reaching almost to the anterior margin on the side. Venter greyish yellow pollinose, with yellow pile, the last segment with black pile.

Holotype—♀, Victoria, British Columbia, May 16, 1916, (R. C. Treherne); No. 563, in the Canadian National Collection, Ottawa.

Eucyrtopogon diversipilosis new species

Allied to *nebulo*, but a little smaller and with less hairy abdomen, hoary pollen along the sides of the front. The lower fringe of curved hairs are shorter than the width of the costal cell, as in *nebulo*.

Length 9 mm. *Male*. Face a little convex, strongly convex retreating below, silvery white pollinose, with a brownish spot on either side above. Mystax black, the hairs tipped with white. Front yellow-brown pollinose in the middle, more or less broadly whitish pollinose on the sides. Pile of front entirely black. Antennae black, silvery in some lights, with white hairs, but usually two or three black ones on the second joint; first joint longer than the second; third one and one-quarter times as long as first two, style equal to length of first two, rather slender. Occiput wholly fine white haired and whitish pollinose.

Thorax shining black, more or less thickly tawny brownish pollinose; in the middle with a complete white longitudinal line, which is a little widened anteriorly and expanded just before the scutellum; on either side a broader, abbreviated stripe, interrupted before the suture, the spot formed by the front section triangular, postalar calli above and below, the lateral margins, humeri and a broad longitudinal stripe on the middle of the pleura, white. On either side of the median white stripe is a broad, subopaque black stripe. Pile of the dorsum black, sometimes a few white hairs on the middle line in front and on the postalar calli; pile of pleura almost all pale; there may be a few brown or black hairs on the mesopleura and some of the trichostical hairs may be black, but they are chiefly pale, although often have a reddish tinge. Scutellum with a whitish bloom, and fine white hair; with eight or ten slender apical whitish to brown bristles.

Legs wholly black, with white pile; the bristles slender, usually brown or blackish, but many pale. The pile is long but not very abundant, so that

the ground color is not obscured. Front tibiae slightly curved, the others straight. Inner anterior side of front tibiae and inner posterior side of the hind ones rusty reddish and the tarsal pads, rusty yellowish pubescent. Hind coxae not with distinct tubercle but with small projection.

Wings yellowish on posterior basal half; the apical half grey, with a broad, interrupted fascia behind the apex of the first vein, a small spot on the third vein midway between the crossvein and furcation and a transverse spot beyond the furcation, mostly situated behind the third vein, hyaline; all the crossveins and furcations bear brown spots, the first series forming an abbreviated, rather broad fascia about the middle of the wing. The curved hairs on the costa are decidedly shorter than the width of the costal cell.

Abdomen shining blue black, the sides of each segment with a posterior elongate oval sericeous spot. Pile short, sparse, tawny, on the dorsum; on the sides long, whitish basally, grading to brownish at apex. Last two ventral segments with dense, erect blackish or brown pile.

Female. Very similar, but less densely pilose. Mystax thinner and with some fine white hairs intermixed.

Thorax much more whitish, so that the brown pollen is left as large, isolated spots; one before and behind the suture; one just behind the humeri and another inside them contiguous with the black stripe, and another running to the postalar calli from the outer side of the one behind the suture. Humeri white pilose.

Wings much paler, not at all yellowish.

Pile of abdomen short, more sparse, all pale.

Holotype, ♂, Chilcotin, B. C., May 14, 1920, (E. R. Buckell), No. 561 in the Canadian National Collection, Ottawa.

Allotype, ♀, same data.

Paratypes, ♂, same data; ♂, same locality and collector, May 12; ♂, Banff, Alta., Sept. 20, 1922, (C. B. D. Garrett).

This species can generally be readily distinguished from *nebulo* by the wholly black tibiae, as in that species they have a reddish cast on the outside in the ♂. The ♀ is smaller, but less readily separated. Both these species are readily separated from ♂ *calcarata* by the shorter curved hairs on the costa.

Eucyrtopogon calcarata new species

Curved bristles on costa almost all black; abdomen of ♂ with 7 pairs of greyish sericeous spots; anterior apex of posterior coxae produced forward into a tuberculate spur, only slightly so in the ♀; spots on sixth and seventh in ♀ occupying the whole length of the segments.

Length 10-11 mm. *Male.* Face and front sub-shining black, the former covered with greyish white, the latter with thin, brownish yellow tomentum. Pile black, on the occiput towards the neck and wholly on the lower half, white; tips of facial hairs cinereous. Antennae black, first two segments with thin, yellowish tomentum, third with cinereous bloom, about equal in length to the two first combined, evenly tapering from its rather broad base to slender apex; style about as long as third segment, slender.

Thorax shining black in ground color, covered with tawny tomentum or pollen, the median stripe, a spot on the humeri, one at the inner end of the suture

and an elongate one above the root of the wings silvery whitish; the geminate stripe shining blackish brown, abbreviated behind but connected with an elongate, more laterally placed spot before the scutellum; a roundish spot before the suture and an elongate, narrow one behind, shining; pleura with greyish white bloom, the mesopleura with tawny. Pile on dorsum black, on pleura luteous; a few brown hairs on the epimeron above. Scutellum convex, with tawny bloom in certain lights; pile white, bristles slender, brownish, their apices yellowish or whitish.

Legs shining blackish, pile tawny, the ends of the hairs broadly white; Bristles brownish basally. Hind coxae with the interior apex produced forward into a conical tubercle; a smaller tubercle on the trochanters between the coxae and femora, on the lower posterior side.

Wings mostly hyaline, cinereous villous apically, the crossveins and furcations clouded with brown. Lower row of curved hairs on the costa as long or slightly longer than the width of the costal cell.

Abdomen shining black, on the disc with rather short yellowish hairs; on the sides with long luteous pile almost white basally, on the apical segments subapically with some black hairs, extensive on the sixth segment. Last ventral segment with a tuft of brownish red pile apically. On either side with seven greyish, sericeous, elongate oval spots, that on the seventh segment occupying the whole length on the lateral fourth.

♀. Similar. The dark thoracal markings are brown instead of black, the abdominal spots are broadest laterally, those on the sixth and seventh segments occupying the full length of the segments laterally, those on the seventh small.

Holotype, ♂, Banff, Alta., October 27, 1917, (N. B. Sanson), No. 562, in the Canadian National Collection, Ottawa.

Allotype, ♀, April 25, 1917, (Sanson).

Paratypes, ♀, April 25, 1917, (Sanson); 3 ♀, Cranbrook, B. C., (C. B. D. Garrett); ♂ ♀, Nicola, B. C., June 1, 1922; ♀, Aspen Grove, B. C., June 15, 1922; ♀, Quilchena, B. C., May 21, 1921, (P. N. Vroom).

Distinguished by the spur on the hind coxae and the long, lower row of hairs on the costa.

Eucyrtopogon nebulo O. S.

Front dull brown, the orbits more yellowish; abdomen of male with six pairs of isolated greyish white spots.

Length 10.5—11.5 mm. *Male*. Face moderately convex; covered with greyish white tomentum; a sub-oval reddish brown area on either side above the middle; pile black, the apices of the hairs brassy yellow. Front dull reddish brown, the orbits narrowly yellow pollinose; pile black, the hairs on the ocellar swelling tipped with yellow or white. Occipital ciliae black, their tips white, occiput with yellow pile above, white below. Antennae black, the first two segments with yellowish bloom; pile brownish and luteous, the one or two long hairs brown; third segment tapering, more strongly narrowed at the apical third; arista slender, about half as long as the third segment.

Dorsum of thorax with a posteriorly abbreviated geminate blackish brown longitudinal stripe, the median stripe greyish white with a yellowish tinge on

the disc; a narrow stripe on either side behind the suture, and a pair of posteriorly contiguous spots rising from the posterior margin, the inner one triangular, on the apical sixth, shining blackish brown, immediately before and behind the suture large oval brownish areas; a yellowish sericeous spot on the humeri, the inner end of the suture and on each side of the middle about the anterior third; elsewhere, the thorax is brownish red or tawny tomentose, on the pleura whitish or pale yellowish; on the middle line of the dorsum in front more or less white. Scutellum convex, apparently tawny tomentose, the pile rather long, white, the spines white but appearing more or less luteous or brownish.

Legs black, the tibiae chestnut brown except apically, and the immediate base; pile brownish red, the long hairs with whitish or yellowish apices; many of the long hairs blackish.

Wings hyaline on basal two-fifths, elsewhere smoky or luteous villous with numerous clear areas; brownish areas on the cross-veins and the bifurcations of the third vein.

Abdomen shining greenish black, with rather sparse, tawny hairs on the disc; on the sides with long, moderately abundant brown hairs, basally almost whitish; the apical ventral segment with a posteriorly sharply limited band of black hairs. On the sides of segments one to six posteriorly a sub-oval greyish sericeous spot, those on the third to fifth segments narrowed laterally, those on the sixth broadly separated from the lateral margin.

Female. Sublateral oval spots and stripes tawny in some lights, the tomentum generally more greyish, the sericeous areas more extensive. Pile on abdomen wholly paler, the spots all wider laterally, the seventh segment without spots.

♂, Royal Oak, B. C., April 19, 1917, (R. C. Treherne); ♀, Royal Oak, May 5, 1917, (Treherne); ♀, Duncan, B. C., June; ♂, no locality label, Oct. 7, 1904.

Eucyrtopogon varipennis Coquillett

Wings with four elongate marks forming an irregular line and the costal border of the wing beyond the first longitudinal vein deep brown.

Length 9.5 mm. *Male.* Face only slightly swollen; whitish pollinose in some lights, with a rich, brownish spot above on either side; front with similar pollen, which is largely tawny toward the middle. Pile of face extending almost to antennae, the hairs all black, their tips white. Front and upper portion of occiput black haired, the hairs mostly with white tips; occiput elsewhere with fine whitish pile, the orbital border white pollinose. Antennae entirely black, more or less silvery dusted, the first two joints with black hair; first two joints of equal length, the third moderately longer than the first two combined; style almost as long as the third joint, rather slender.

Thorax shining black; covered with a cupreous brown pollen, which leaves a broad, geminate, median stripe and an interrupted one on either side, of the dorsum, shining; on either side of the geminate stripe is a silvery white stripe, which is interrupted behind the root of the wings, as stripe is oblique on its posterior portion, rising at the corners of the scutellum, crossing the

inner end of the postalar calli and not quite reaching the root of the wing. Pile of the dorsum nearly all black, as there are just a few pale hairs in the middle in front, and on the postalar calli. The longer hairs are not conspicuous and are mostly tipped with white. Pleura white haired; the mesopleura above and behind with black pile; trichostical pile fine, white, but not conspicuous owing to the strong black bristles. Scutellum tawny pollinose with long, rather wooly white pile; the longer apical hairs not conspicuous, whitish.

Legs entirely black; adorned with long and short black, tawny or brownish and white pile, which is especially long behind the front and middle tibiae, the middle tibiae bear on their outer side a row of six or seven black bristles which are tipped with white; the front and hind ones bear several apical bristles. The front tibiae are curved towards the front, the middle ones are curved anteriorly and outwardly, while the hind ones are straight, a little swollen apically and as long as their femora. The antero-interior surface of the front and hind tibiae is densely yellow pubescent. The posterior side of the front tarsi bears long, whitish or slightly yellowish hair, which is conspicuous but not very dense.

Wings greyish; yellowish behind the sixth vein and in the costal cell, with deep brown markings as follows: a pair of elongate, narrowly connected spots in the first basal cell, just before the middle; an elongate oval spot filling the submarginal and part of first submarginal cell just beyond the branching of R_{2+3}; an elongate spot on the anterior crossvein; and the costa broadly beyond the apex of the first vein. Squamae velvety brown, with white fringe. Halteres brown.

Abdomen shining blue black, each segment with an apical grey pollinose spot which is twice as wide as long. Pile short, black, on the disc; longer, tawny, yellowish and white on the sides. The last two ventral segments bear an apical fringe of long, brownish pile.

♂, Victoria, B. C., March 21, 1921, (R. Glendenning); ♂, Victoria, B. C., May 10, 1916, (R. C. Treherne).

Cyrtopogon Loew

Face gibbose, the swelling reaching the base of the antennae. Third antennal joint usually coarctate, with a basal swelling, narrowest just beyond the base, widest about the middle, rarely but slightly coarctate. Thorax convex, but not strongly so, usually largely pollinose, usually with bristles on lateral margin. Scutellum plain or convex, sometimes wholly or partly pollinose, with or without apical bristles. Legs often more or less specialized with peculiar arrangement of pile; no curved spine on front tibiae. Abdomen tapering in ♂, usually widest in middle of ♀, and rather acute; rarely chiefly pollinose, the segments usually with grey pollinose spots on posterior angles or with entire fasciae, rarely wholly shining. Wings often with faint yellowish clouds on crossveins, sometimes with one or two large, brown spots; third longitudinal vein (R_1 and R_2) branching distinctly beyond the discal crossvein (the vein closing the outer end of the discal cell.) Genotype, *C. ruficornis* Fabr., Europe.

Table Of Species.

1. Males 2
   Females 20
2. Middle tarsi with a broad pad formed by lateral pile, on the last two or more segments; anterior tarsi with silvery crest above 3
   Middle tarsi not with disc like termination, the anterior tarsi not with a crest above 5
3. Anterior tarsi with the crest extending to the base of the basitarsi ..... *praepes* Wilist.
   The crest extends only to the base of the second joint, but there may be a few white hairs on the disc of the basitarsi 4
4. Crest on front tarsi wide, concealed from ventral view by dense black hair; disc of middle tarsi limited to last two joints ..... *callipedilus* Loew.
   Crest narrower, not much wider than tarsal joints and not concealed from ventral view by black hair; middle tarsal disc not limited to last two joints ..... *willistoni* Curr.
5. Wings with one or two large black or brown spots or brownish beyond the middle 6
   Wings at most with the crossveins slightly clouded or with pale cinereous or yellowish clouding 9
6. Coxae wholly black pilose; wings brownish beyond the middle, fading out behind and posteriorly; beard wholly black ..... *curtistylus* n. sp.
   Coxae largely yellow or white pilose 7
7. Wings with a large apical spot and a smaller one covering the apical third of the anal cell ..... *bimaculata* Walk.
   Wings with only the apical spot or brownish anteriorly beyond the middle 8
8. Mystax wholly black, the hairs stout ..... *dasyllis* Willist.
   Mystax yellow, some black hairs below ..... *dasylloides* Willist.
9. Last joint of front tarsi remarkably elongated and flattened; disc of scutellum almost plane 10
   Last joint of fore tarsi normal 11
10. Tibiae wholly black; posterior four tarsi piceous; the front ones reddish ..... *lineotarsus* n. sp.
    Tibiae and tarsi yellowish, the apex of the front tibiae piceous ..... *leptotarsus* n. sp.
11. Trichostical pile practically all, or more than half black 12
    Trichostical pile all, or practically all, white 15
12. Abdomen with the terminal segments carinate or subcarinate dorsally, when viewed from behind; abdomen chiefly yellow pilose 13
    Abdomen not with the apical segments forming a keel; pile of abdomen almost all black 14
13. Sides of the specialized abdominal segments broadly, very densely, short black pilose; keel not sharp, the middle or keel portion bare and polished except for the narrow transverse pilose fascia; anterior tibiae black pilose ..... *aurifex* O. S.

Sides of keel much more narrowly densely pilose, the keel with quite evident but not abundant appressed hairs pointing towards the apex of keel; anterior tibiae white pilose ..... *albitarsis* Curr.

14. Hind tarsi silvery white pilose above (confer leucozona) .. *inversus* n. sp.
Hind tarsi wholly black haired ..... *montanus* Loew.

15. Disc of scutellum usually plane, usually entirely grey pollinose, but the sides may be black 16
Disc of scutellum convex, not grey pollinose 18

16. Sides of disc of scutellum broadly shining black, the apical margin pollinose ..... *lutatius* Walk.
Sides of disc of scutellum pollinose; whole apical margin shining 17

17. Pile of mesopleura all white; first two abdominal pollinose fasciae normally entire ..... *nugator* O. S.
Pile of mesopleura black, with only a few white hairs below; pollinose abdominal fasciae all interrupted ..... *sansoni* n. sp.

18. Pile of mesopleura pale; third antennal segment red, tibiae all yellowish except their apices; all the tibiae and tarsi white pilose; bristles on fore tarsi short, yellow ..... *marginalis* Loew.
Pile of mesopleura black; third antennal segment black, tibiae only reddish on basal half or less; posterior four tarsi black haired above; bristles on fore tarsi stout, black ..... *falto* Walk.

19. Omitted.

20. Large species; basal abdominal segments evenly yellow pilose, the last two black pilose; elongate ..... *dasylloides* Willist.
Smaller; pile in tufts or not wholly yellow on basal segments 21

21. Scutellum densely grey or yellowish pollinose, usually flat 22
Scutellum not densely grey pollinose, usually convex 26

22. Only middle line of the scutellum pollinose, the apex pollinose *lutatius* Walk.
Scutellum wholly pollinose, the immediate apex shining 23

23. Mystax wholly black 25
Mystax white or yellow on the sides 24

24. Tibiae all reddish or yelow, darker apically ..... *leptotarsus* n. sp.
Tibiae piceous or black ..... *predator* n. sp.

25. First abdominal segment with a posterior greyish pollinose crossband .. *profusus* O. S.
First abdominal segment only greyish pollinose on the sides 37

26. Sides of abdomen with conspicuous alternate black and yellow pile ..... *willistoni* Curr.
Sides of abdomen with not conspicuously contrasted pile 27

27. Pile on sides of first three segments long, wholly yellow ..*willistoni* Curr.
Pile usually shorter, or wholly black or yellowish 28

28. Trichostical pile practically all black 29
Trichostical pile almost all white or yellow 33

29. Abdominal crossbands broadly interrupted 30
Abdominal crossbands normally entire 31

30. Third antennal segment red ..... *varans* n. sp.
Third antennal segment black; anterior crossvein near the middle of the discal cell ..... *bimacula* Walk.

31. Sternopleura with fine white hair ..... *leucozona* Loew.
Sternopleura with fine black hair 32
32. Tibiae often chiefly reddish, the white hair on hind tibiae not abundant; if long and appearing silvery the tibiae are reddish ..... *montanus* Loew.
Tibiae always wholly black; white hair on hind tibiae long, rather dense, appearing silvery from basal view ..... *inversus* n. sp.
33. Abdominal crossbands normally entire 38
Abdominal crossbands interrupted, or third antennal segment red 34
34. Third antennal segment red ..... *marginalis* Loew.
Third antennal segment black 35
35. Posterior tibiae reddish on basal half ..... *falto* Walker.
Posterior tibiae more extensively reddish or all black 36
36. Posterior tibiae and tarsi all black; mystax black and yellow ..... sp.
Posterior tibiae and tarsi chiefly red; mystax black and whitish *plausor* O. S. *callipedillus*
37. Pile of mesopleura all black; abdominal bands normally all interrupted.... ..... *sansoni* n. sp.
Pile of mesopleura pale, sometimes a few long, black hairs in middle; first two abdominal fasciae normally entire ..... *nugator* O. S.
38. All the tibiae rather pale yellow ..... *albitarsis* Curr.
Front tibiae blackish or piceous ..... *leucozona* Loew.

(to be continued)

Mailed June 11th, 1923.

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PRELIMINARY NOTE ON THE TERMINOLOGY APPLIED TO THE PARTS OF AN INSECT'S LEG*

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In the movements of locomotion, the hind legs of an insect are used largely for pushing the insect along (i.e., with a "kicking movement"); the hind coxae are therefore not so freely mobile, and in a dead insect, the hind legs usually project backward along the body. The forelegs are used largely for pulling the insect along; the fore coxae are slightly more mobile than the hind ones, and the forelegs are frequently directed forward in a dead insect. The middle legs, on the other hand, are used chiefly as supports in the tripod formed by the sets of legs in walking, and the middle coxae are usually freely mobile. The middle legs may project outward or even backward or forward in a dead insect.

The varying positions assumed by the legs in a dried specimen (in which the legs cannot readily be moved about without breaking them off) make it extremely difficult to apply a uniform terminology to homologous surfaces in all of the legs, since the outer or lateral surface of one leg may be turned inward or mesally in another, etc., and this difficulty led Grimshaw, 1905, (Entom. Mon. Mag., 2d. Ser. Vol. 16, p. 174) to propose the following method of designating the surfaces of any leg. If the leg be stretched out horizontally (or perpendicular to the body wall) so that the tarsus and tibia are as nearly as possible in a line with the femur, there are eight surfaces which Grimshaw designates as the dorsal, postero-dorsal, posterior, postero-ventral, ventral, antero-ventral, anterior, and antero-dorsal (counting clock-wise, as one looks at the lateral surface of the body). The ventral surface of the femur is applied to the ventral surface of the tibia when the leg is tightly closed upon itself, and certain entomologists apply the terms "flexor surface" to the surfaces thus opposed when the leg is closed, and they then call the opposite surfaces the extensor surfaces. The ventral surface of the tarsus is sometimes called the "plantar surface" by entomologists. There are a number of other terms which have been applied to the surfaces of the leg (Bolivar, Genera Insectorum, Fasc. 90; Schnabl, 1906, Wien. Ent. Zeitschr. Vol. 25, etc.); but Grimshaw's terms are the ones most generally used.

The *trochantin* (or *trochantinus*) is not considered as part of the leg in the following discussion, since it is clearly associated with the pleural region in lower insects, and only in the higher forms, such as the Coleoptera, etc., is it closely associated with the coxa. In many primitive insects the trochantin is divided by an oblique suture into an *antetrochantin* (*atn* of Fig. 6) and a *post-trochantin* (*ptn* of Fig. 6). The oblique *trochantinal suture* corresponds to an internal *endotrochantin*, or ridge for muscle attachment. The prothoracic

*—Contribution from the Entomological Laboratory of the Massachusetts Agricultural College, Amherst, Mass.

trochantin is sometimes divided into a *basitrochantin* and a *distitrochantin* by a transverse cleft, but this division does not occur in many insects. Embedded in the basicoxal membrane near the base of the coxa are several small plates described by Crampton and Hasey, 1915 (Zool. Jahrb. Abt. Anat. Bd. 39, p. 6).

Coxa. The coxa of lower insects has two principal pivots, of which the chief pivot is the coxal process of the pleuron, formed by a downward projection of the pleural region at the base of the pleural suture. The tip of the trochantin forms a second pivotal point in many insects, but in the lower forms such as the roaches (Fig. 6) the tip of the trochantin may serve as a "pulling" point for moving the coxa by means of the muscles attached to the movable trochantin. In many holometabolous insects (Diptera, Trichoptera, Neuroptera, etc.) a third pivot of the coxa is furnished by a process of the sternal region which forms the coxal process of the sternum—a prolongation of the sternal region into the mesal surface of the coxa.

At the base of the coxa is a *coximarginal region* (*cm* of Fig. 6) and a ventral continuation of the pleural suture into the coxa forms the *meral suture, msu,* which divides the coxa into a *merocoxa* or *meron* (*me* of Fig. 6) and a *eucoxa, cc.* In the lower insects such as the termites, roaches, stoneflies, etc., the meron *me* is clearly a demarked posterior portion of the coxa (Fig. 6), and it is only in the higher insects that the meron becomes somewhat closely associated with the epimeron, so that it is quite incorrect to maintain (as some investigators have done) that the meron is a detached fold of the epimeron.

In certain roaches (Fig 6), Carabid Coleoptera, etc., the posterior coxae bear a *coxacrista, cxc,* or ridge, in the median portion of the coxae, while a furrow or *coxafossa, cxf,* lateral to the ridge, receives the femur, *fc,* when the latter is drawn up to the body. A process of the coxal ridge, called the *coxal process,* projects over the base of the trochanter of the hind legs in certain Coleoptera, roaches, etc. The sharp edge of the coxal ridge is called the *coxacarina.* The *coxatheca* is the cavity for receiving the head of the trochanter; and the *lateral* (anterior), and *median* (posterior) *trochantifers* are the processes of the coxa against which the condyles of the trochanter articulate.

Trochanter. The "head" of the trochanter (*trochocaput,* labelled *trc* in Fig. 9) is received in the coxatheca or articular cup at the apex of the coxa; and the *trochocondyles* (one of which is labelled *tcd* in Fig. 9) or condylar processes of the trochanter, one of which is anterior and the other posterior, articulate with the corresponding trochantifers or trochanter-bearing processes of the coxa, mentioned above. These form the pivotal points in the extensor and flexor movements of the trochanter, the extensor and flexor tendons of the trochanter being attached on either side of these pivotal points.

The trochanter articulates with the coxa, but does not articulate with the femur in any insect I have examined, and it is quite possible that the trochanter may be a constricted-off portion of the femur. At any rate, the so-called second segment of the trochanter in the Tenthredinoid Hymenoptera (labelled *bfc* in Fig. 7) appears to be a demarked portion of the femur. This demarked portion of the femur is not closely associated with the trochanter *tr,* and is only imperfectly marked off from the femur in many primitive Hymenoptera, so that it is preferable to designate it as the *basifemur* (*bfe* of Fig. 7) rather than by the terms which imply that it is a part of the trochanter (i. e., such terms as

distitrochanter, trochanterellus, etc.); and the term apophysis, sometimes applied to it, should be restricted to the internal processes of the sternal region.

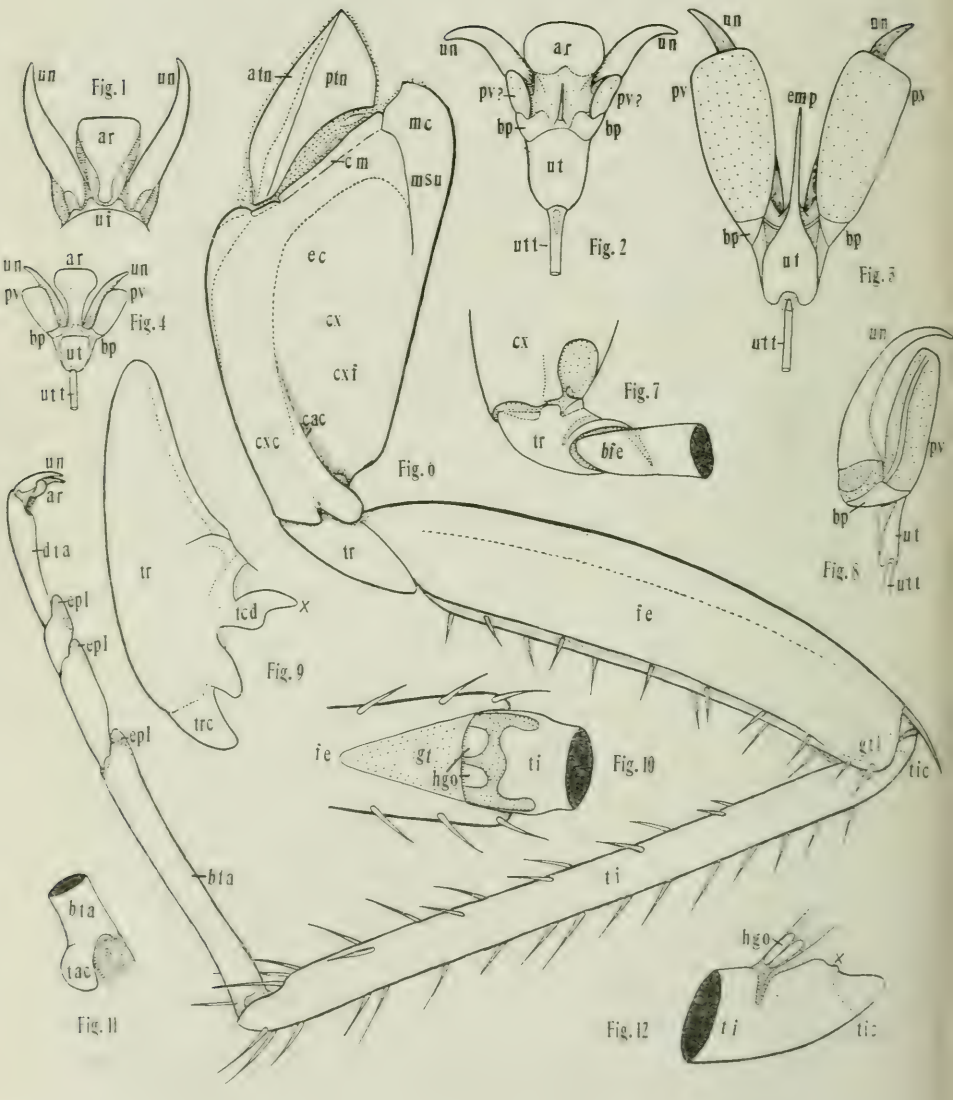
Femur. The femur does not articulate with the trochanter in any insect thus far examined, and, as was mentioned above, this may indicate that the trochanter is a constricted-off portion of the femur. Distally, the femur articulates with the tibia, and the articulating surface of the femur to which the tibia is joined, is called the *gonytheca* (*gt* of Fig. 10) by entomologists. The gonythecal lobes, *gtl* of Fig. 6, prevent lateral movements of the tibia, and *tibiafers* (anterior and posterior) furnish the tibia-bearing processes with which the condyles of the tibia articulate. As was mentioned before, the dorsal surface of the femur is also called its extensor surface, and its ventral surface is also referred to as its flexor surface.

Tibia. The *tibiacaput* (*tic* of Figs. 12 and 6) or head of the tibia is received in the portion of the femur called the femur cup, and the *anterior* and *posterior tibiacondyles* articulate with the processes of the femur called the tibiafers. The *hypogonya* (*hgo* of Fig. 12) are chitinous plates below the angle of the "knee," and serve as points of attachment for the flexor tendons of the tibia. The cup at the apex of the tibia, for the reception of the head of the basal segment of the tarsus, is the *tibiatheca*. The dorsal surface of the tibia is sometimes called its extensor surface, and its ventral surface is sometimes referred to as its flexor surface. The longer apical spine-like structures at the tip of the tibia are sometimes called tibial spurs. In homologizing the spurs, spines, etc., on the tibia (i. e., the calcaria, etc.) of various insects, Comstock's differentiation between spines, spurs, setae, etc., should be borne in mind, since the origin of these structures is not the same in all cases; but it is frequently more convenient to use the same designation for all of the spine-like structures in a certain area of the tibia, regardless of their origin.

Tarsus. The segments of the tarsus may be referred to as the *tarsomeres*. The basal tarsomere is called the metatarsus when it is longer than the other tarsomeres, but the term metatarsus should refer to the entire tarsus of the metathoracic leg, so that the designation *basitarsus* is a preferable term to apply to the basal tarsomere (*bta* of Fig. 6). The head of the basal segment of the tarsus, or *tarsocaput* (*tac* of Fig. 11) is received in the tibiatheca, or cup of the tibia, and anterior and posterior *tarsocondyles*, or tarsal condyles, articulate with the corresponding anterior and posterior tarsofers, or tarsus-bearing processes of the tibia. The terms sarothrum, palma, planta, etc., have also been applied to the basal segment of the tarsus when it is modified for certain particular purposes in specialized groups of insects, but the term basitarsus is of more general application.

The distal segment of the tarsus may be termed the *distitarsus* (*dta* of Fig. 6), since the term onychium, which is sometimes applied to it (in certain Hymenoptera) is also used for the arolium, empodium, and other structures, and it is impossible to determine the original or most widespread use of the term onychium. The terms digitus, ungula, etc., are also loosely applied to the distitarsus by some investigators.

The claws are usually termed the *ungues*. The terms ungula, unguicula, onyches, etc., have also been applied to the claws, but the designation ungues is preferable to all of these. The claws are usually borne by the *unguifer* (*uf* of



TERMINOLOGY OF AN INSECT'S LEG.

Fig. 1) or dorsal process at the tip of the terminal segment of the tarsus (distitarsus). A small retractile plate, the *unguitractor* or *tarsule* (tarsulus) labelled *ut* in Figs. 2, 3, 4, and 8, situated ventrally at the apex of the distal segment of the tarsus, may possibly represent a rudimentary tarsal segment, but this is not very probable. The plate in question is connected with the ventro-basal region of the claws by membrane and other structures, and serves to retract or flex the claws when it is pulled back by the *unguitractor tendon* (*utt* of Figs. 2, 3, etc.,) connected with its base.

Between the claws, and frequently articulating dorsally with the unguifer (*uf* of Fig. 1) is a pad-like structure *ar,* which the students of the lower groups of insects term the *arolium.* It is sometimes incorrectly referred to as the pulvillus, empodium, etc., but these terms should be restricted to other structures which are not strictly homologous with the arolium. The so-called pulvilliform empodium of certain Diptera, such as the one shown in Fig. 4, *ar,* is probably an arolium, since it occupies the typical aroliar position between the claws, and articulates dorsally with the unguifer, as does the arolium of lower insects (Fig. 1). I would therefore designate this structure as an arolium, rather than an "empodium" in these Diptera. The true *empodium* is a process of the plate labelled *ut* in Fig. 3, where the empodium bears the label *emp.* A great many heterogeneous structures pass under the name "empodium," but the true empodium is a process of the unguitractor plate *ut,* and does not articulate dorsally with the unguifer, as the arolium does (Fig. 1) in many lower insects. The unguitractor frequently bears apical setae which may be called the parempodia, or unguitractor setae. These are usually two in number. A pseudempodium, or median bristle-like structure resembling the empodium may occur between the bases of the claws, and this has been mistaken for the true empodium in some cases.

The *pulvilli, pv* of Figs. 3, 4 and 8, are pad-like structures on either side of the unguitractor plate, and they are usually closely associated with the ventro-basal region of the claws. In many insects a *basipulvillus* or basal plate occurs in the proximal region of each pulvillus (*bp* of Figs. 3, 4, 2, etc.) and, as shown in Fig. 8, this basal pulvillar plate, *bp,* may extend laterally around the base of the claw. I do not know how the pulvilli arose, but two possibilities suggest themselves as to their origin. The condition met with in certain Hymenoptera in which the arolium is partially divided by a deep dorsal furrow, suggests that the pulvilli may be portions of a divided arolium; and in certain Hemiptera-Homoptera there are conditions suggestive of a demarcation of the arolium into lateral regions, while the nature of the pulvilli in such Diptera as the one shown in Fig. 4 gives some further indication that they may be detached portions of the arolium *ar.* On the other hand, the pulvilli may be developed from the somewhat membranous areas at the base of the claws, such as those labelled *"pv?"* in Fig 2, and the relation of these membranous areas to the basipulvilli *bp* in Fig. 2 is certainly suggestive of the relation of the true pulvilli *pv* to the basipulvilli *bp* in Fig. 3. This further suggests that the pulvilli may be detached portions of the claws, and the nature of the claws in certain Ephemerids (in which the claws are quite pad-like) would lend weight to the view that the pulvilli are detached portions of the claws, which become deeply cleft in many insects, thus

suggesting the beginning of a process that might end in formation of the pulvilli.

The designation, pulvilli, is frequently applied to the small pad-like structures (*epl* of Fig. 6) on the under side of the tarsal segments, but the term pulvilli should be restricted to the structures labelled *pv* in Figs. 3 and 4, which are not homologous with the pads under the tarsal segments. The designations plantulae or soleae would be very appropriate for the pads labelled *epl* in Fig. 6, but unfortunately these terms have been applied to other structures. To avoid confusion, I have referred to the structures *epl* of Fig. 6 as the *euplantulae*, thus preserving the term plantulae, which is extremely appropriate for the structures in question—and might even be used in this sense if it were clearly understood that no other structures were indicated by the term. The three euplantulae on the basal segment of the tarsi of grasshoppers, etc., may indicate that the basal segment (basitarsus) is in reality compound in these insects, being made up of three tarsomeres united. The abnormal tarsus of the roach shown in Fig. 6, however, exhibits only three euplantulae, despite the fact that the second tarsomere appears to be formed by the union of the second and third tarsomeres occurring in normal roaches of the same species.

It is rather peculiar that so many holometabolous insects have pentamerous tarsi, while so many lower insects have tarsi composed of fewer than five segments. This led me to suggest in a former paper, that the lower number might be the primitive one, but the question is by no means settled, since it would appear that five segments may be nearer the original number, and the reduced number may be due to fusion or loss of segments.

The designation, propedes, has been applied to the uropods or pleopods occurring on the abdomen of larval insects, but it is preferable to designate the larval abdominal legs as *uropods* or *pleopods* (the posterior ones being termed the *postpedes*), and to use the term *propedes* (or *propods*) for the prothoracic legs, as the term indicates. The mesothoracic legs would then be designated as the *mesopedes* (or *mesopods*), and the metathoracic legs would be termed the *metapedes* (or *metapods*). This usage is in conformity with the rule restricting the application of the prefixes pro-, meso-, and meta-, to structures of the prothorax, mesothorax, and metathorax respectively.

ABBREVIATIONS

ar...Pad between tarsal claws (*arolium*).
atn...Anterior division of trochantin (*antetrochantin*).
bfe..Basal region of femur (*basifemur*).
bp...Plate at base of pulvillus (*basipulvillus*).
bta..Basal tarsomere (*basitarsus*).
cac..Coxal carina (*coxacarina*).
cm..Marginal region of coxa (*coxamargin*).
cx..*Coxa*.
cxc..Coxal ridge (*coxacrista*).
cxf..Coxal fossa (*coxafossa*).
dta..Distal segment of tarsus (*distitarsus*).
ec....Anterior region of coxa (*eucoxa*).
emp..*Empodium*.
epl...Plantula, s. str. (*euplantula*).
fe...*Femur*.
gt...*Gonytheca*.
gtl..*Gonythecal lobes*.
hgo.Plates beneath angle of "knee" (*hypogonia*).
mc..*Merocoxa* or *meron*.
msu..*Meral suture*.
ptn..Posterior division of trochantin

(*postrochantin*).
pv...*Pulvilli.*
ta...*Tarsus.*
tac..Head of tarsus (*tarsocaput*).
tcd..Condylar process of trochanter (*trochocondyle*).
ti...*Tibia.*
tic..Head of tibia (*tibiacaput*).
tr...*Trochanter.*
trc..Head of trochanter (*trochocaput*).
uf..Structure bearing ungues (*unguifer*).
un...Tarsal claws (*ungues*).
ut...Plate for retracting or flexing claws (*unguitractor* or *tarsulus*).
utt..*Unguitractor tendon,* or tendon for retracting or flexing claws.
x....Pivotal point.

EXPLANATION OF PLATE

Fig. 1. Dorsal view of tip of tarsus of the roach *Periplaneta americana.*
2. Ventral view of same.
3. Ventral view of tip of tarsus of the Dipteran (Asilid) *Proctacanthus heros.*
4. Same of Leptid Dipteran *Chrysopilus thoracicus.*
6. Hind leg of roach *Periplaneta americana* (abnormal specimen), lateral view.
7. Trochanteral region of leg of Tenthredinid Hymenopteran, lateral view.
8. Lateral view of claw and pulvillus of *Proctacanthus.*
9. Mesal view of hind trochanter of *Periplaneta.*
10. Ventral view of apex of femur of *Periplaneta.*
11. Lateral view of head of basal tarsomere of same.
12. Lateral view of head of tibia of same.

STUDIES IN CANADIAN DIPTERA.

I. Revision Of The Asilid Genus Cyrtopogon And Allied Genera.

BY C. HOWARD CURRAN,

Ottawa, Ont.

(Continued from page 125)

Cyrtopogon dasyllis Williston

Large; 16 to 18 mm.; hair of head and thorax wholly black; second, third and fourth abdominal segments with thick, even, yellowish pile.

Length 16 to 18 mm. *Male.* Face moderately gibbose, more prominent above; thickly yellow or greyish yellow pollinose; pile of head wholly black. Front subshining in the middle, with similarly colored pollen to that on face. Occiput grey pollinose. Antennae black, third joint reddish, its base diffusely brownish. First antennal joint about twice as long as wide; second slightly longer than wide; third joint one and one-half times as long as the first two combined; widest about its middle. Style short, stout, obtuse, shorter than the second joint.

Thorax shining black, thinly reddish brown pollinose, with some irregular patches of more yellow pollen. Scutellum shining black, convex. Pile of thorax wholly black; the hairs of the scutellum and epipleura tipped with pale.

Legs black; tibiae with the posterior surface piceous reddish; tarsi all reddish. Hairs of legs moderately abundant, black. Pile on front tarsi white, shining. Pubescence on front and apex of hind tibiae brassy yellow.

Wings pure hyaline, with a large, apical brown spot; last section of sixth vein bordered with brown.

Abdomen shining black; the first four segments with even, dense, yellowish pile, the first segment with a few black hairs anteriorly. Apical segments and genitalia with slightly shorter black pile.

Female. Mystax yellow in the middle; beard largely yellow; "5" on mesonotum rather distinct, yellow pollinose.

Wings beyond the middle decidedly fuscous, paler posteriorly and along the margin apically.

Four specimens of both sexes from Kaslo, B. C., September, (J. Cockle). One specimen has been compared with the type.

Cyrtopogon curtistylus new species

Large, allied to *dasylloides* but the coxae black haired; head black haired; front legs with some silvery white pile.

Length, 16 to 18 mm. *Male.* Face strongly gibbose, more prominent above; the mystax bright yellow, laterally narrowly bordered by stouter black hairs, below widely bordered; thinly pale greyish pollinose. Front shining black; occiput thinly greyish; hairs of head and beard wholly black. Antennae black; first joint twice as long as wide; second two-thirds as long as first; third one and one-half times as long as the first two combined, wider than the first joint, scarcely narrowed basally, with almost parallel sides; style very short, obtuse.

Thorax shining black; wholly black haired; with conspicuous marginal bristles. Scutellum shining black, with coarse, black pile of even length.

Legs shining black; simple; wholly black pilose except on front legs; pile rather abundant; longer on front tibiae; on the front tibiae behind on the apical fifth and the upper surface of their tarsi with silvery white pile, that on the tarsi short, subappressed, not extending onto the last joint.

Wings hyaline on basal half; on the outer half yellowish brown, darker in the middle and front; largely fading out apically and posteriorly.

Abdomen shining black, apparently without grey pollinose markings; first segment with short, reddish yellow pile; second, third and fourth with even, erect, long orange colored pile; apical segments with less erect shorter black pile.

Holotype, ♂, Cache Junction, Utah, June 3, 1912, (H. R. Hagan), in C. W. Johnson Collection.

Paratype, ♂, same data, No. 578, in the Canadian National Collection. Readily distinguished from *dasyllis* by the clouded wings.

Cyrtopogon albitarsis Curran

Abdomen with reddish yellow pile forming dense apical segmental bands; third antennal segment red; anterior tibiae and tarsi with a posterior fringe of short, silvery hair.

Length 11 to 12 mm. *Male.* Face moderately gibbose, convex receding, the pile golden yellow, below, and up the sides to the middle, stouter, black; ground colour obscured by pale yellowish pollen. Front yellow pollinose; wholly black pilose. First two antennal joints black, with black hairs; third joint reddish yellow, constricted slightly just beyond the base; longer than the two basal segments combined, broadest about its middle; style usually black,

but the base may be yellow. Occiput greyish yellow pollinose, black pilose; beard white, well separated from the eyes.

Thorax with a very conspicuous greyish yellow pollinose 5 on either side, the enclosed portion deep shining black, the margin behind the suture and a triangular projection inside the postalar callus, also shining, elsewhere with greyish yellow or yellow pollen, the median line narrowly greyish in front on either side of which is a broader grey stripe; or the anterior curve of the five and the median geminate stripes may be ashy. Pleura yellowish grey pollinose. Pile black; on the propleura white, or the epipleura mixed black and golden. Scutellum convex with a golden brownish pubescence in some lights; pile black.

Femora all black, the apices narrowly yellow; pile black above, not very abundant, pale yellow below and behind. Tibiae reddish, the anterior ones paler, immediate base and apices black or blackish, anterior ones with moderately long silvery white pile posteriorly, short yellow pile anteriorly; a few black bristles exteriorly, several slender ones below anteriorly near the base and three below posteriorly, some of which may be reddish. Middle tibiae with silvery white pile in front and exteriorly, yellow pile elsewhere; with numerous black bristles. Hind tibiae wholly black pilose, the end below golden pubescent. Anterior tarsi yellow, with silvery pile which forms a dense fringe posteriorly; on the basal two segments the pile is bright yellow anteriorly. Pile all white on middle tarsi, which are darker than the anterior ones but paler than their tibiae. Hind tarsi with black hairs, in colour, similar to the middle tibiae.

Wings sometimes slightly tinged with luteous apically. Squamae fuscous with whitish border and fringe.

Abdomen black; second, third and fourth segments each with a posterior silvery greyish pollinose band, which appears yellow beneath the pile.. First four segments reddish or tawny pilose, sparser and shorter anteriorly so that the pile appears in broad bands. Fifth, sixth and seventh segments triangular when viewed from behind, black pilose; with a narrow transverse band of short, black pile about their middle dorsally, the last one or two segments with a steel blue reflection on the "keel." Hypopygium black; with a conspicuous fringe of black hairs sub-basally.

The ♀ differs so markedly from the ♂ that I describe it in detail, and designate it as the Allotype.

Female. Facial gibbosity a little more even than in ♂. Mystax rather thin, black, in the middle with finer, but not condensed, white hairs. Front moderately yellowish white pollinose, black pilose. Occiput grey pollinose, black pilose, fine white pilose on lower half except along the orbits. First two antennal joints piceous, whitish pollinose, black haired; third black, rather slender, conspicuously concave on basal half. Style slender, slightly longer than in ♂.

Thorax shining black, pleura greyish white pollinose. Middle line of mesonotum rather broad, brownish in some lights, black in others, thinly pollinose, in front with a short, median, narrow, whitish pollinose stripe; in some lights with three narrow shining stripes, the opaque stripes slender. The grey

pollen leaves a small oval spot inside and behind the humeri, a large roundish one before the suture, a less roundish one behind the suture, dark, thinly pollinose in some lights, the posterior of the thorax similar. Hairs of mesonotum black, but intermixed with white before the scutellum. Pleura white haired, the mesopleura wholly and a few of the trichostical hairs black.

Femora piceous, their narrow apices and remainder of legs dirty yellowish, the front tibiae a little darker. Femora white pilose above, dorso-anteriorly and apically, with black pile. Tibiae black pilose, the hind ones on the outer side with shorter white hair, on the inside with longer black hair. All the tarsi black haired.

Wings clear hyaline, the veins not clouded.

Abdomen shining black, the second to fifth segments with greyish white pollinose apical fasciae, the last one broadly interrupted, all widest laterally, narrow in middle. Pile on disc, except basally, short, black; on sides longer, white.

Allotype—♀, Banff, Alta., July 9, 1916, (C. G. Hewitt), No. 501, in the Canadian National Collection, Ottawa.

The type ♂, Banff, July 17, 1916, (C. G. Hewitt); and paratype ♂, Banff, July 23, 1909, (N. B. Sanson) are before me.

I did not associate the ♀ with the two males at the time the species was described, owing to the great differences between the two, but there can be no doubt that they are the same species and the ♀ was taken only eight days before the type ♂. Sexual dimorphism is quite common in the genus, but is not so well marked in other groups, although a good example occurs in *C. bimacula,* the ♀ of which lacks the alar spots.

Cyrtopogon aurifex O. S.

Allied to *albitarsis* but the last two tarsal joints are black; the legs are more reddish, mystax paler, pollinose abdominal bands wider, etc.

Length 12 to 13 mm. *Male.* Face gibbose, most prominent on the upper half, densely pale yellow pollinose; mystax whitish, with a margin of stouter black hairs, which are abundant at the oral margin. Front rather golden pollinose, shining just at the antennae and about the ocellar triangle. Occiput shining black; yellow pollinose like the front above, pale yellow pollinose below. Pile of front and occiput black, on the lower half of the latter, except against the eyes, white, but not dense. Antennae black, third joint red; first joint twice as long as wide, second two-thirds as long as first, a little longer than wide; third one-third longer than the first two combined; style as long as the width of the second joint of antennae, slender, tapering, not acute. Antennal hair black. Palpi black, black haired.

Thorax shining black, the pleura bright yellow pollinose, almost tawny in some lights. Mesonotum with a narrow, entire median vitta on either side of which is a narrow, dark brown vitta, outside of which is a broader tawny yellow vitta, the latter and the median one united just before the scutellum, but the lateral ones do not reach the apex of the thorax. The 5 is well formed, rather golden colored, but the dash is disconnected and oblique and the curve is sub-interrupted before and behind; on either side on the sub-posterior third of the mesonotum is a broad, golden yellowish stripe running over the posterior

end of the 5, best seen from behind. Pile of thorax black; bristles black; only the propleura with fine white pile. Scutellum convex, yellowish pollinose on disc basally, with rather stout black hairs.

Femora black, just their extreme apices yellow. Tibiae yellowish red, their apices broadly black; tarsi of same color, their last two joints black. Coxae whitish pilose. Femora moderately black haired, with pallidly yellow hair below. Tibiae black haired, only the posterior apex of the front ones with some silvery white hairs. Tarsi black haired, the first three joints of the front ones with silvery white pile, which is more abundant behind and in front. Pubescence on front and hind tibiae and tarsal pads brassy yellowish.

Wings hyaline, the stigma, and all the furcations and crossveins clouded with brownish or brownish yellow. Squamae white, with bright yellow border and short white fringe. Halteres yellow, the stem fuscous.

Abdomen rather dull black, with the second to fourth segments densely tawny or reddish pilose, the bases and narrow apices of the segments bare, so that the abdomen appears markedly banded; middle of the segments anteriorly but thinly pilose; first segment short yellow pilose, not pollinose, with a tuft of brownish pile on anterior angles; second segment with black pile on anterior angles; second to fourth segments yellow pollinose on posterior half. Fifth, sixth and seventh segments greenish blue in the middle, shining black on sides, the middle compressed and roundedly carinate; pile on eighth segment wholly, and the preceding three except the carina, very dense, short, black, obscuring the ground color; the fifth to seventh segments each have a narrow sub-basal, transverse, very dense, short, pilose band and a second one just beyond the middle, but the basal one may be quite at the base of the segment in some cases. Genitalia shining black, with moderately sparse pile.

One ♂, Vancouver Island, B. C., June 4, 1888, (G. W. Taylor). This specimen was compared with the type and showed no difference whatever. The pile on the sides of the terminal segments is much more dense than in *albitarsus* and the segments are much less strongly carinate. I have not a ♀ before me, but it may be distinguished from ♀ *albitarsus* by the color of the legs. For doubtful ♀ with entire bands compare with that species and this.

Cyrtopogon bimacula Walker

Wings of ♂ with large apical cloud and smaller cloud covering apex of anal cell; wing of ♀ a little greyish beyond end of first vein and about apex of discal cell; tibiae and tarsi yellow or reddish, both with blackish apices.

Length 8.5 to 15 mm. *Male.* Face moderately gibbose, whitish pollinose; mystax white, margined with black hairs which are more abundant along the oral margin, not dense. Front yellow pollinose, with a median shining black stripe which expands above the antennae and surrounds the ocellar tubercle. Pile black, long, rather fine. Occiput shining black, white pollinose below, yellow pollinose along the orbits above. Pile black, on the lower half white, just a few black hairs along the orbits below. Antennae black, thinly greyish pollinose; black haired. First joint hardly twice as long as wide, the second not quite as long as first; third almost one third longer than first two combined, rather narrow basally, broadest at apical fourth; style short, not longer than least width of second joint, rather stout, with sharp spine at apex.

Thorax shining black, pleura above, yellowish pollinose; shining on more than lower half. Mesonotum yellowish pollinose; with a darker stripe on either side of the median stripe of about the same width as the stripe but abbreviated behind. A stripe running from inside the humeri obliquely to the side margin, and the side margin wholly, but narrowly so between the suture and wings, shining black; a broad, darker area on either side commencing before the suture, sub-interrupted on the suture and not quite reaching the shining posterior margin; posterior margin whitish pollinose in middle. Pile and bristles black; only the propleura white pilose. Scutellum shining black, disc yellowish pollinose basally; hair rather fine, long, black.

Femora black; tibiae reddish, their apices broadly black, the front ones more broadly so exteriorly; tarsi reddish, the last joint black, the two preceding somewhat blackish above. Femora black haired, yellowish white haired below, postero-ventrally and at immediate bases; tibiae and tarsi with black hair and bristles, the pubescence brassy yellow.

Wings hyaline; a large cloud apically commencing at the apex of the first vein, and extending back to just basad of crossvein, thence extending obliquely to behind the intercallary vein, and a spot in the apical third of the anal cell, spreading somewhat outside it, brownish, the immediate border of the wing beyond the apex of the second vein hyaline. Squamae white with yellow border and short white fringe. Halteres yellow, the stem fuscous.

Abdomen shining bluish black, metallescent, the second to fifth segments with an elongate, subtriangular greyish white pollinose spot on the posterior angles. Pile yellow, on the sides longer, white, on the sericeous spots subappressed and rather conspicuous. Genitalia with rather sparse, short, black and reddish hairs.

Female. Usually much larger but most specimens average about 12 mm. Mystax usually yellow, at least whitish yellow, the black hair not more abundant.

Median line of thorax slender, tapering, yellow, but wholly separating the dark vittae, and narrowly bordered on the front half by black.

Legs similar in color, but the pale parts a little darker. Front femora almost all black haired, the hind ones almost all pale pilose, the hind tibiae black haired except on the inside.

Wings lacking definite spots, but slightly darkened (greyish or cinereous) in the same regions as in the ♂.

Abdominal pollinose spots longer, separated by about the length of one spot, but small on the fifth segment.

Described from ♂, Douglas, Man., June 10, 1921, (N. Criddle), and ♀, Nordegg, Alta., July 7, 1921, (J. McDunnough).

This species shows remarkable variation in size and the two specimens before me represent the extremes, the ♀ being slightly larger than any others which I have seen, while the ♂ is as small as any. It occurs across Canada east of the Rockies, and extends down to Pennsylvania in the east and down the western slopes of the Rockies into Colorado.

Two females from Sudbury, Ont., and one ♀ from Truro, N. S., have the clouds on the wings more brownish yellow and more evident on the crossveins.

Cyrtopogon nugator O. S.

Scutellum flat, grey pollinose; abdomen with narrowly interrupted or entire segmental bands; antennae wholly black.

Length 10 to 12 mm. *Male.* Face rather strongly gibbose, the greatest prominence above the middle; mystax moderately abundant, stout, black; greyish white pollinose. Front thinly grey pollinose, more thickly so laterally; black haired. Occiput silvery white pollinose, white pilose, a few black hairs along the orbits. Antennae black; thinly greyish pollinose; first joint twice as long as wide, second practically as wide as long; third over one and one half as long as first two combined, broader than first joint, widest at apical fourth; style one fourth as long as third joint, rather stout.

Thorax grey pollinose; a broad median stripe, abbreviated behind, narrowly interrupted on front part, on either side a broader stripe, commencing half way between the front margin and suture and sub-interrupted at the suture, brownish pollinose. Mesonotum sparsely black haired, with rather fine black bristles; humeri, prothorax and pleura, fine white haired; the meso-pleura with a few black hairs. Scutellum flat on disc, grey pollinose; its margin shining; pile white, fine, on disc; stout, black on whole margin.

Legs shining black, simple; femora white pilose, a few black hairs apically; tibiae white pilose, the front ones black pilose externally; bristles black. Front and hind tibiae yellow pubescent. A row of short, black bristles on posterior surface of hind tibiae.

Wings limpid hyaline. Squamae white, with yellow border and fine white fringe. Halteres yellow, the stems fuscous basally.

Abdomen shining blue-black; the first to fifth segments each with the posterior margin broadly-grey pollinose, the bands moderately interrupted, although the second, third and fourth band are normally entire. Sixth segment with a small, triangular pollinose spot on posterior angles. Pile wholly white, longer on sides, especially basally.

Female. Quite similar, the pile a little shorter, the abdomen slightly broader.

♂, Saanich District, B. C., June 7, 1919, (W. Downes); ♀, Vernon, B.C., June 8, 1920, (N. L. Cutler); ♀, Agassiz, B. C., April, 1919, (A. B. Baird).

Cyrtopogon sansoni new species

Allied to *nugator* O. S., but the tibiae in the female are wholly black haired, the pollinose bands are decidedly interrupted, the scutellum is wholly black haired and the thorax much paler pollinose.

Length, 9 to 10 mm. *Male.* Face moderately gibbose, almost evenly convex, shining black, thinly covered with brown pollen, with small, transverse yellow pollinose band below the antennae; mystax wholly black, rather dense, not coarse. Front wholly thinly grey pollinose with rather abundant, crinkly black hair. Occiput whitish pollinose, less thickly so above, with a few fine black hairs above, and many on the lower third against the eyes, the latter crinkly. Antennae black, thinly grey pollinose, the apices of the first two segments without pollen; first segment scarcely twice as long as wide, second two-thirds as long as the first, practically as broad as long, both black haired; third joint nearly twice as long as first two, rather slender on basal third, not stout;

style not as long as width of second joint, tapering, not slender.

Thorax greyish white pollinose, with a pair of pale brown stripes on either side of the middle line, well separated from the front and posterior margin; with an obtuse, sub-roundish spot before the suture and a rather narrow stripe behind, moderately separated from the median geminate brown stripe, brown pollinose, the mesonotum more shining behind this stripe. There is also a small, brownish spot just behind the outer end of the suture. The pleura are evenly pollinose, only the narrow suture between the meso- and sternopleura shining. Pile of mesonotum, fine, moderately abundant, crinkly, not long, but longer behind and the fine bristles black. Mesopleura with similar pile. Sternopleura above, propleura and trichostical pile white, Scutellum plane, grey pollinose, its margin shining black. Wholly black pilose, without distinct bristles, the hairs moderately stout, crinkly.

Legs shining black, simple; femora with fine white pile, the front four on apical half, except behind, with more abundant black pile, hind ones with only a few black hairs apically. Tibiae black haired, the middle ones with short, sparse white hairs behind, the hind ones wholly white haired; tarsi wholly black haired. Spines all black; pubescence on front and hind tibiae and tarsal pads, bright yellow.

Wings hyaline, the third vein branching well beyond the discal cross-vein.

Abdomen shining blue black, the second to sixth segments with a posterior grey pollinose band, broadly interrupted in the middle, all the bands slightly wider laterally, the anterior one less widely interrupted, the apical ones slightly increasingly more broadly so; the seventh and eighth segments in well preserved specimens greyish yellow pollinose with the apex shining black; first segment grey pollinose on lateral fifth. Pile short, black on disc, longer, fine, whitish on sides. Genitalia white pilose, a few black hairs below.

Female. Face evenly whitish grey pollinose, with a transverse brownish spot above the oral margin, the mystax less dense.

Thorax still paler pollinose, the darker areas brownish yellow.

Femora with slightly more pale pile, the tibiae wholly black pilose. Sixth and seventh abdominal segments wholly shining.

Holotype, ♂, Banff, Alta., July 5, 1915, (N. B. Sanson); No. 583, in the Canadian National Collection, Ottawa.

Allotype, ♀, Banff, Alta., July 9; 1916, (C. G. Hewitt).

Cyrtopogon lutatius Walker

Scutellum plane, grey pollinose, the lateral margins broadly shining.

Length 9 to 11 mm. *Male.* Face rather strongly gibbose, yellowish white pollinose; mystax wholly white, fine, dense. Front yellow pollinose, a small black spot just above the antennae, the narrow anterior margin of the ocellar tubercle also dark; pile sparse, fine, white. Occiput white pollinose, becoming brownish yellow above, almost all white pilose; many black hairs above and a few yellow ones along the eyes below. Antennae black, thinly yellowish pollinose, with fine white hair and one black bristle on lower apex of second joint; first joint twice as long as wide, slender, second more robust, and equal in length; third joint one and one third as long as the first two combined, thickest at the

middle, of medium width; style equal in length to the first joint, moderately stout, slightly tapering, with short, apical bristle.

Mesonotum greyish or brownish yellow pollinose, a broad stripe contiguous to the middle line, on either side, more brownish; inner side of humeri, and a broad stripe on the apical two thirds, not quite reaching the hind margin and interrupted at the suture, blackish. Very narrow lateral margin and the upper surface of the postalar calli shining black. Posterior margin grey pollinose. Pleura greyish or yellowish pollinose, the meso- and sternopleura with more brownish yellow pollen, the former with an oblique, broad oval shining spot on lower and posterior margin. Pile of mesonotum short, black, only a narrow band on anterior and posterior margins pale haired. Meso- and sternopleura white haired; trichostical pile black, often a few white hairs. Scutellum shining black on the sides, the middle broadly, expanded at the base and extending along the apex, grey pollinose; with sparse white pile and fine apical bristles.

Legs wholly black, rather sparsely short white pilose, the bristles white or yellowish; tarsi black haired, coxae grey pollinose, white haired. Legs wholly simple.

Wings hyaline, slightly greyish on apical half; the third longitudinal vein (R_{4+5}) branches a considerable distance beyond the discal crossvein. Squamae whitish with fine white fringe. Halteres yellowish, the stem a little fuscous basally.

Abdomen shining blue black, the second to sixth segments with a greyish posterior crossband on about the lateral third; the crossbands are of equal width and length, so that the anterior ones are more broadly separated, the posterior ones gradually less widely separated, only the median ones actually separated by one third the width of the segment; the first segment is grey pollinose laterally, the spot rather quadrate; seventh and eighth segments grey pollinose except the posterior margin, the black slightly convex anteriorly. Abdominal hairs sparse, short, black and yellow, alternately appearing chiefly of either color from different views. Genitalia yellow haired.

Female. Gibbosity shining on upper half; mystax thin, margined by a row of black hairs, the black hairs abundant below. Front with the lower third and sometimes a projection upward on either side, shining. Hairs all black, or a few white ones on front of ocellar tubercle. Occiput without the stouter yellow hairs below. First two antennal joints sometimes piceous, the apex of the second reddish, this joint with two long bristles below, one in the middle, the other apical.

Pollen on thorax more greyish, the broad, interrupted stripe brownish pollinose.

Middle and front tibiae sometimes piceous or yellow brown except the apical fourth.

Abdomen broader than the thorax, widest at the middle, the pollinose cross-bands longer, the first three interrupted by about one-fifth the width of the segment, the fifth narrowly so or entire, the seventh segment with an entire sub-apical fascia, the eighth bare when visible.

Five specimens: ♂, Jordan, Ont., June 1, 1919; ♀, Jordan, June 6,

1920, (C. H. Curran); ♀, Bathurst, N. B., July 26, (J. N. Knull); ♂, Drumgold, Pa., June 11, 1919, (A. B. Champlain); ♀, Carlisle Junction, Pa., June 27, 1910

Cyrtopogon varans new species

Third antennal joint red on apical two-thirds; mystax black and yellow, tibiae reddish with black apices.

Length 15 mm. *Female.* Face strongly gibbose, the swelling reaching to the base of the antennae; without a ridge; mystax composed of coarse black hairs, the middle hairs less coarse and whitish yellow; greyish white pollinose. Front shining black, only pollinose along the eyes and above; vertex black. Occiput grey pollinose; black pilose, below, except along the orbits, yellowish white pilose. Antennae black; third joint yellow on apical two-thirds or more; first two joints grey pollinose, black haired. First joint three times as long as wide; second a little longer than wide; third one-fifth longer than first two combined; rather broad, style tapering, acute; one-fifth length of third joint.

Mesonotum with the sides and a spot before the scutellum shining black; densely brown pollinose; a narrow median stripe on anterior half, a stripe along the inner side of the humeri, a narrow 5, with only the curved part and a large apical spot, yellow pollinose. Pile wholly black; three long black bristles, one just before the suture; two before the postalar calli, black. Pleura yellow pollinose; black pilose; propleura white pilose. Scutellum shining black, with a yellowish grey sheen basally, convex, black pilose, the apical hairs very long and a little stouter.

Femora shining black; tibiae piceous reddish, their apices broadly black; tarsi black, the bases of the joints reddish. Pile and bristles of legs black; some pale pile beneath all the femora.

Wings hyaline; a little greyish apically; all the crossveins and furcations broadly brownish.

Abdomen shining black, the second to fifth segments each with an elongate triangular, transverse, greyish pollinose spot on either side apically, the spots not over one-fifth the distance across the segment. Pile yellow; whitish basally on the sides.

Holotype, ♀, Gaspe, Quebec, Sept., 4, 1914, (C. H. Young), No. 576, in the Canadian National Collection, Ottawa.

Cyrtopogon marginalis Loew.

Grey pollinose crossbands of abdomen narrowly interrupted, obscurely interrupted in ♀; third antennal joint red; legs almost wholly white haired, with black bristles; scutellum convex; pleura wholly pale pilose.

Length, 11 to 15 mm. *Male.* Face moderately gibbose, most prominent above, pale yellowish pollinose, the sides with more whitish pollen; mystax composed of moderately stout black hairs, above with chiefly whitish, slightly finer hair. Front thinly greyish yellow pollinose, with black, moderately long hairs, all the hairs on the ocellar tubercle white. Occiput silvery pollinose, more yellowish above; along the orbits black haired; elsewhere, including the vertex, with white pile. First antennal joint black, its apex narrowly red; twice as long as wide; second joint reddish with a broad black sub-basal band, slightly

wider than long, two-thirds as long as first joint; third joint reddish yellow; practically twice as long as the first two combined, narrower than the first joint, the sub-basal half concave below; style black, moderately narrow, slightly tapering, as long as first joint, its spine small but conspicuous.

Mesonotum brownish yellow, three median stripes brown, with a blackish stripe separating them; on either side of the outer blackish stripe on the posterior two-thirds is a broad, slightly tapering, more shining stripe, interrupted at the suture and not reaching the posterior margin. The lateral and posterior margins wholly, broadly shining black, including the humeri and postalar calli, but narrowly interrupted at the suture. Pleura yellowish white pollinose, a rectangular shining spot on the mesopleura and another below the wings. Thorax wholly rather fine, white pilose, the shining lateral margins of the mesonotum with black pile, the bristles fine, black, not conspicuous. Scutellum convex, shining black, white pilose, without bristles.

Femora black, a reddish spot below at their base and the apex, reddish; tibiae reddish, their apices blackish; anterior tarsi reddish yellow, the remainder reddish, their segments more or less dark apically, the hind ones chiefly piceous. Legs wholly white pilose except as follows: brassy yellow beneath the hind femora; black beneath the middle and hind tibiae, and just a few black appressed hairs above on the middle tarsi. Pile wholly rather long, dense beneath the femora and tibiae; a row of long white hair on disc of hind tarsi. Bristles on front tarsi short, fine, yellow, elsewhere chiefly black.

Wings hyaline, the veins yellow on basal half; the apex of the wing in front with a grayish cloud from the apex of the first vein to the apex of R_5 (posterior section of third longitudinal vein) this cloud best seen by naked eye. Halteres yellow.

Abdomen shining blue black, the second to fifth segments each with a moderately interrupted grey pollinose apical fascia, wider laterally; pile on disc short, on sides long; white on base and on posterior margin of each segment, black across the middle, the black pile condensed sub-laterally so as to form rather conspicuous tufts on second and third segments; the last segment and genitalia above wholly pale pilose, the latter sparsely black haired below.

Female. Mystax white in middle, not dense. Pollen of mesonotum brighter, more tawny; front tarsi not wholly yellow, but similar to middle. Wings slightly clouded with brownish yellow on crossveins. Abdomen normally with the spots connected in the middle by a narrower pollinose spot, which is frequently absent in old specimens. Pile on lateral margins of abdomen wholly narrowly white; on the base of the segments, black, on the apical third, white; on the second segment only black in the middle laterally, the base bare.

♂, Walpole, Mass., May 26, 1908, (C. W. Johnson); ♀, Sharon, Mass., May 20, 1908, (C. W. Johnson).

This species has been recorded from Canada, but I have not seen specimens. The reddish antennae will distinguish it from all but *varans* and that species has chiefly black haired pleura.

(To be continued)

HORSEFLIES COLLECTED BY DR. J. M. ALDRICH IN ALASKA IN 1921.

BY JAMES S. HINE,

Columbus, Ohio.

Tabanus affinis Kirby.

Length 16—19 mm. This is of similar general appearance to a large group of northern species with hairy eyes and the sides of the abdomen widely reddish or yellowish. The front is moderately wide, subcallus pollinose, frontal callosity rather large, rounded, smooth shining black, and separated from a denuded elongate space above it. Palpi rather large at base, although not appearing swollen, and gradually tapering to a rather well defined point. Third segment of the antenna wide, strongly excised above with a distinct acute angle at base.

The species occurs in all the extreme northern states from the Atlantic to the Pacific and has been widely collected in Canada. The present collection contains twenty-one specimens taken at Anchorage, Xenana and Fairbanks, Alaska.

Tabanus gracilipalpis n. sp.

Length, 16 millimeters. Suggestive of *affinis,* average size somewhat smaller than that species and in general form less elongate. Female, palpi somewhat elongated, slender, only very gradually tapering and ending in a blunt point. Third segment of the antenna reddish, infuscated dorsally and apically, wide and rather short, annulate portion much shorter than the basal, distinctly excised dorsally at base, dorsal basal angle prominent and acute. Subcallus not denuded, front grayish-yellow pollinose, gradually narrowed anteriorly where it is about one half millimeter in width; ocelligerous tubercle prominent and shining, frontal callosity nearly as wide as the front leaving only a very narrow pollinose space on either side, curved inward dorsally and connected with an extension above nearly half its width and reaching very near half way to vertex; the entire structure is rather dull black in color and shows peculiar wrinkled appearance; eyes pilose. Thorax black with gray and black pile, thinly gray pollinose and with the usual stripes dorsally; wings hyaline, veins dark, costal cell pale yellowish, stigma brown; anterior leg black, tibia only slightly reddish basally; femora of other legs black, narrowly red apically, tibiae and tarsi nearly wholly reddish dorsally. Abdomen bright reddish-yellow on sides of first three segments and with a very narrow grey margin bearing a few pale yellow hairs posteriorly on each segment, first segment widely beneath the scutellum, second and third segments more narrowly, and all of following segments black; abdomen may be said to be shining reddish yellow with a nearly uniform black middorsal stripe slightly over two millimeters in width. Ventrally, first segment, anterior margin of second, a somewhat obscure midventral line on two and three and all of following segments black, otherwise venter reddish yellow.

In comparison with *affinis* the present species appears less elongate, the palpi are more slender, the front is narrower and the frontal callosity is quite different. The slender palpi easily separate it from *epistates.*

Type female from Camp 334 near Fairbanks, Alaska, July 9, 1921, and

two paratypes from Nenana, Alaska, June 27, 1921, in the U. S. National Museum. One paratype from Fairbanks, Alaska, June 30, 1921, in the author's collection.

Tabanus nudus McDunnough.

Smaller than *affinis*. Palpi pale, distinctly swollen at base and rather rapidly narrowed to a distinct point. Subcallus denuded and shining, joined above with the frontal callosity, which is separated from a linear, denuded, area above it. Front somewhat narrowed below. General color very much as in *affinis*.

One specimen from Anchorage, Alaska, June 10, 1921, one from Nenana, June 27, 1921, and one from Healey, same date.

Tabanus epistates O. S.

Palpi distinctly swollen basally and narrowed to a point, subcallus not denuded, antennae notably red, third segment only slightly excised dorsally, dorsal basal angle not very pronounced; front quite narrow and plainly narrower below, frontal callosity rather narrow, slightly higher than wide and united with a linear extension above it. This is one of the smaller species of the *affinis* group but somewhat variable in size.

One female from Nenana, Alaska, June 27, 1921.

Tabanus sexfasciatus n. sp.

Length 13 millimeters. A black species with a very narrow white fascia on the posterior margin of each abdominal segment. Wings somewhat infuscated on anterior half. Palpi slender, yellowish in general color, often slightly infuscated outwardly, narrowed to a point at apex; face and subcallus uniformly gray pollinose; antenna generally dark, almost black; third segment short, reddish at base, scarcely excised dorsally, basal angle not prominent; basal portion somewhat widened and a little longer than the apical portion. Front at vertex about two thirds millimeter in width, slightly narrowed below, densely gray pollinose, frontal callosity shining black, nearly as wide as the front, about as high as wide, curved dorsally and connected with a denuded spindle shaped marking which reaches halfway to vertex. Ocelligerous tubercle distinct, eyes pilose. Thorax black, thinly gray pollinose, the usual lines faintly discernible on the dorsum; legs black, all the tibiae reddish basally; wing hyaline, costal cell pale brown, stigma brown, veins surrounding the basal cells margined with brownish and a very slight coloring at furcation of the third vein. Both dorsum and venter of the abdomen are black with a very narrow gray border to each segment, the second dorsal segment at each side is very faintly reddish over a small area.

Type female from Camp 334, near Fairbanks, Alaska, July 9, 1921, in the United States National Museum. Two paratypes with the same data as the type; three paratypes from Camp 347 near Fairbanks, Alaska; one paratype from Nenana, Alaska, June 27, 1921, and two paratypes from Healy, Alaska, July 6, 1921, also in the United States National Museum. Two paratypes taken at Camp 347, Alaska, June 22, 1921, in the collection of the author.

There are also four paratypes in the Canadian National Collection at Ottawa under No. 594, as follows:—two females, Fort Simpson, N.W.T., (June 29, 1922) (C. H. Crickmay); one female, Fort Wrigley, N.W.T., (July 1,

1922) (C. H. Crickmay); one female, East Coast of James Bay, Que., (July 1920) (F. Johanssen).

Not to be confused with either *rhombicus* or *osburni* for both of those species have the subcallus denuded and there are other differences.

The specimens of this species are very uniform in size and coloration. There is a slight variation in the frontal callosity, however. In some specimens the spindle shaped denuded marking at the middle of the front is attached to the callosity, in some it is detached.

Tabanus septentrionalis Loew.

General form of the body narrow and somewhat elongate, abdomen dorsally with three longitudinal rows of spots, the middorsal row is composed of triangles, while on either side there is a prominent row of rounded spots extending from the first to the sixth segment, one spot to each segment. Palpi pale and distinctly swollen basally, nearly as long as the proboscis; front at vertex only very slightly more than a half millimeter in width, sides nearly parallel, frontal callosity nearly as wide as the front with an unconnected spot above, antenna dark, third segment reddish basally and with a very meager dorsal basal angle.

The present species, as it has been considered, is somewhat variable. Specimens from Western North America often have dilute yellowish wings with the body more pollinose and consequently somewhat duller. Eastern specimens quite regularly are brighter, more shining black with transparent wings. The Alaska specimens at hand agree more nearly with the latter. Intermediate and otherwise variable specimens demand attention frequently. I have found no structural characters that will separate these phases.

Twenty-five specimens were taken by Dr. Aldrich at Anchorage, Fairbanks, Nenana and Healey, Alaska, during June and July, 1921.

Tabanus metabolus McDunnough.

One specimen from Nenana, Alaska, taken June 27, 1921. The species is much like *illotus* Osten Sacken, but may be separted from that species by the denuded subcallus, the more robust form and the greater width and different form of the third antennal segment. Described in the Canadian Entomologist for October, 1922.

Haematopota americana O. S.

A single specimen of this northern species was taken at Fairbanks, July 4, 1921. This is the first record I find for Alaska. Osten Sacken had it from Fort Resolution, Hudson Bay Territory, Lake Superior, Dakota, Montana, British Columbia and other Northern localities.

Chrysops carbonarius Walker.

A specimen from Fairbanks, July 1, 1921. The first record for Alaska.

Chrysops lupus Whitney.

One specimen from Fairbanks, July 1, 1921 and two others from the same locality July 4, 1921. Reported previously from Colorado and from Laggan, Alberta.

Chrysops nigripes Zetterstedt.

Face with yellow pollinose intervals separating the facial callosities

from the cheeks, frontal callosity shining black; legs and antennae entirely black, wing hyaline and black, black as follows: costal and marginal cells, basal two thirds and apex of first basal, base and very narrow apex of second basal, first submarginal except a small area stretching between second and third veins just beyond the branching of the third vein, a very narrow area in anterior part of second submarginal, basal half of first posterior, discal, bases of second and third posterior, more than half of fourth posterior; a large part of fifth posterior and apex of anal diffuse black. Characteristic for this species among North American Chrysops is the angular extension of the cross band of the wing along the third vein to where this vein branches. Abdomen black dorsally, each segment with a narrow gray border which expands into a triangle at the middle, first and second segments narrowly bright yellow at the extreme sides.

Four specimens; one, Fairbanks, June 30, 1921, two, Nenana, July 5, 1921 and one, Anchorage, July 21, 1921.

Previously reported from northern Europe by Zetterstedt, from Sitka, Alaska, by Loew and from Kukak Bay, Alaska by Coquillett. Two specimens were taken at Lakeview, Montana, August 4, 1920, by A. N. Caudell.

A NEW RACE OF BRENTHIS FROM COLORADO (LEPID.)

BY WM. BARNES AND F. H. BENJAMIN,

Decatur, Ill.

Brenthis frigga Thunberg

1791, Thun., Diss. Ent. Suec., II, 23, *Papilio*.

Typical *frigga* presumably does not occur in North America. The broad band of pale spots on the underside of the secondaries immediately separates *frigga* from *saga* and allied North American forms, which probably represent a distinct species. However, as the authors possess only seven specimens of typical *frigga*, they prefer to describe the following new subspecies as a geographical race of *frigga*. Should the North American forms ultimately prove to represent a distinct species, the name *frigga* can be dropped and *saga* substituted.

Brenthis frigga race sagata nov.

Upper side; primaries; similar to poorly marked specimens of *frigga* from Europe, the lines and markings clean-cut; secondaries; with the blackish suffusion of the basal area restricted to the basal half of the cell and anal area; thus differing from *saga* in which the black suffusion of the secondaries occupies nearly all of the basal area to the median band. Underside: similar to *saga*, the maculation usually somewhat more intensified and less suffused.

The habitus of *sagata* so closely resembles *epithore* that the Colorado record of *epithore* in Holland, Butterfly Book, probably represents *sagata*. Holland's figure of *frigga* appears referable to *saga*.

A series of specimens from Alberta can remain as intermediates between *saga* and *sagata*.

Type localities and number and sexes of types: Holotype, ♂, June 24, 1893; allotype, ♀, June 23, 1893; 8 ♂, 5 ♀ paratypes, June 23—24, 1893; all Hall Valley, Colorado, Wm. Barnes: 4 ♂ paratypes, "Colo." (Bruce); 1 ♀ paratype "Colorado".

NOTES ON THE IDENTITY OF SPHINX VANCOUVERENSIS EDW. (LEPID.)*

BY J. MCDUNNOUGH,

Ottawa, Ont.

For some time there has been considerable doubt in my mind as to the correctness of the generally accepted conception of this species, based on the Monograph of the Sphingidae by Rothschild and Jordan. In this monograph the authors (p. 130) are inclined to ascribe seasonal dimorphism to the species, applying the name *"vancouverensis"* to a form with pale thorax, figured on Pl. XIII, fig. 3, and using *albescens* Tepper for the form with blackish thorax (Pl. XIII, fig. 4). In justice to the authors it should be noted that they had no material from Vancouver Island, B. C., before them; had this been the case they would scarcely have fallen into the above error, as all the specimens I have ever examined from British Columbia, (irrespective of date of capture) belong to the form with dark thorax (R. & J.'s fig. 4).

The original description of *Sphinx vancouverensis* (1873, Proc. Calif. Acad. Sci. V, 111) was based on a single specimen taken by Dr. Bremner at Esquimault, Vancouver Island. Correspondence with Mr. F. E. Watson of the American Museum of Natural History elicited the startling fact that the specimen marked "type" in the Hy. Edwards' Collection was from Big Trees, Calif. This "type" is of course, spurious, and has been the cause of errors of identification to be mentioned shortly. Mr. Watson fortunately was able to discover the true type amongst the other material in the collection and has labelled it accordingly, after a careful comparison with the original description. It now bears the following labels:—

Vancouver Island; 2404 (Hy. Edwards' original number); 7226, Coll. Hy. Edwards, (A.M.N.H. label, old catalogue); 24175, (A.M.N.H. new catalogue); red label, type. Mr. Watson writes, "This is the true type of *Sphinx vancouverensis*, the original type label being placed on No. 7227 in error. This specimen is a female (not male as stated) but it agrees exactly with the original description and with the sizes there stated. The two so-called types (*vide* Beutenmuller, Bull. Am. Mus. Nat. Hist., IV, 170) are much smaller. I would call to your attention the submarginal band mentioned in the original description, 'the outer edge of which is deeply dentate.' This exactly describes that band in No. 7226."

An excellent photograph of this type has been furnished me by Mr. Watson, which proves the species to be, not the one figured by Rothschild and Jordan on Pl. XIII, fig. 4, but the one recorded by Taylor and Gibson (Can. Ent. 1909, p. 423), as *perelegans* Edw. I might note that the type is a very worn specimen, but the size and the presence of a distinct black streak in the cell render identification easy. The dentate nature of the outer margin of the pale subterminal band is accentuated by the fact that the veins are denuded of dark scaling. Whether *vancouverensis* will fall as a direct synonym of *perelegans* or whether the name may be used for a racial form is a matter I cannot settle, as California specimens are lacking in the Canadian National Collection; for the present I see no harm in using the name in a racial sense.

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*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept., of Agric., Ottawa.

The above reference leaves our smaller species from Vancouver Island and adjacent territory (R. & J.'s fig. 4) without a name. For the pale form, the *Symphoricarpus* feeder, common in the Prairie Provinces (R. & J.'s fig. 3), the name *vashti* Stkr. seems applicable. Strecker's figure (Lep. Het. Pl. XV, fig 4) gives a very adequate representation of the species; *albescens* Tepper, judging by the description, is simply a form of *vashti* with darker colored thorax; such specimens often occur and vary in the degree of intensity. After a careful comparison of our Vancouver Island and prairie forms I am inclined to ascribe to the former specific rank and describe the species as follows:

Sphinx mordecai sp. nov.

Front whitish gray, this color extending backward over the lower portion of the patagia above the base of the wings; palpi, thorax and dorsal portion of patagia deep black brown, with a slight sprinkling of white scales towards the posterior portion of thorax. Abdomen black, with lateral whitish segmental half-bands; dorsum of abdomen gray-shaded with a centro-dorsal dark line. Prinmaries black-brown shaded with white at the base of the wing and along costal portion of wing to near end of cell; black streaks in the interspaces between veins 2 & 3, 3 & 4, 5 & 6 and a slightly bent black streak from apex of wing to middle of vein 6; a black line, subparallel to outer margin, subterminally between veins 2 and 6, being considerably further removed from outer margin at 2 than at 6; a white, almost even line parallel to outer margin and close to same from below apex to anal angle, the space between this line and the aforementioned black line being partially filled with white scaling; the apical dark dash is also shaded on its costal side by white. Secondaries blackish; base of wings and a curved median band whitish; outer margin with a narrow band of paler color. Length of fore wing 35 mm.; of body 30-35 mm.

Holotype—♂, Penticton, B. C., (May 24, 1921, W. B. Anderson); No. 596, in the Canadian National Collection, Ottawa.

Allotype—♀, Wellington, B. C., (May 30, 1903, G. W. Taylor); in the Canadian National Collection, Ottawa.

Paratypes—4 ♂, 1 ♀, Wellington, B. C., (G. W. Taylor); 2 ♂, Vancouver (Livingston); 1 ♂, Vernon, B. C., (E. P. Venables); 1 ♀, Peachland, B. C., (July 8, 1907, J. B. Wallis); in the Canadian National Collection, Ottawa.

The species is well figured by Rothschild and Jordan (Pl. XIII, fig. 4). Apart from the darker color of thorax and wings it may be distinguished from *vashti* Stkr. by the lack of a second, more indistinct line, bordering the black sub-terminal line on its inner side and attaining inner margin after a slight outward bend and angle.

GRYLLOBLATTA IN CALIFORNIA

BY A. N. CAUDELL,
Washington, D. C.

Grylloblatta is an interesting genus of insects described from Banff, Alberta, some years ago by Dr. E. M. Walker[1] as a new family of Orthoptera. Later it was elevated to ordinal rank by Dr. G. C. Crampton[2] under the name

(1). Can. Ent., vol. XLVI, p. 93-99, pl. VI (1914).
(2). Ent. News, vol. XXVI, p. 346 (1915).

Notoptera. It was established on two specimens, both females, taken on Sulphur Mountain, near Banff, on June 29th, 1913. Later seven more specimens, including both sexes, were studied and described by Walker.[3] All this material is from the type locality and thus the finding of the genus in California, almost a thousand miles across the mountains to the southwest, is a matter certainly worthy of record. Credit for the discovery of this genus in California is due to Mr. H. S. Barber of the National Museum.

While examining a colony of hibernating coccinellid beetles, Mr. Barber had occasion to turn over a piece of board projecting from beneath some debris, and under it he saw a single specimen of an elongate, cricket-like insect, which was instantly recognized as *Grylloblatta* and secured. Gathering dusk, continuation of the storm which had added a foot or more of fresh snow to the old snow covering the ground, and inability to revisit the locality prevented the finding of more material. The coccinellid congregation was found by direction from a miner to a pile of cedar branches showing above the snow. This was on January 23rd of the present year and the locality is in Plumas County, California, on the North Fork of the Feather River, near a deserted cabin by the river, about two and one half miles above the Caribou Power House.

A somewhat careful study of the above specimen shows without doubt its generic position, and the species represented is questionably determined as *campodeiformis* Walker, the type of the genus and the only species so far known.

The structure of the tip of the abdomen of this Californian individual indicates that it is an immature male. The total length of the insect from front of head to tip of abdomen is 20 mm., a rather large size for *campodeiformis,* judging from measurements given by Walker for the male of his species. Walker's measurements were, however, made from dried material, while the present specimen is preserved in spirits. The size of the female of *campodeiformis,* 30 mm., would indicate that the male might well be as large, or even decidedly larger, than this Californian specimen, and thus the size does not militate against this nymph taken by Barber being *campodeiformis.* Structurally, very little was found at variance with the description of *G. campodeiformis,* the only characters noted as not agreeing with those of that species being as follows: The general appearance does not seem to agree very well with *campodeiformis* as figured by Walker, the shape being less campodeiform and more cricket-like. The antennæ are longer than described for *campodeiformis,* measuring 15 mm. in length, and there are forty segments, one of the antennae, however, being broken off at the 30th segment. The terminal segment of the complete antennæ is decidedly more pointed apically than the others. The greatest number of antennal segments noted for Canadian specimens of *campodeiformis* is twenty-nine. If this plurality of antennal segments is indicative of specific distinctness for the Californian specimen or not is a matter of doubt, as *campodeiformis* may indeed possess as many as forty antennal segments, all Canadian specimens of that species examined being in that case imperfect. The detailed figure of the antennae of *campodeiformis* given by Dr. Crampton[4] would indicate, however, that he had drawn from a complete antenna the terminal segment showing a

(3). Can. Ent., vol LI, p. 131-139, pl. VIII-IX (1919).
(4). Can. Ent., vol XLIX, p. 214, fig, (1917).

distinctly more pointed tip than the preceding ones. Dr. Crampton states, however, in the article accompanying this figure, that the drawing is not to be taken as an absolutely accurate portrayal, and thus this particular detail may not be exact. Another apparent point of difference is that the right coxite bears no dorsal appendage at the base as shown by Walker's figure[5], but this is probably due to the immature state of the specimen, as it is said to be much reduced in the nymphs of Walker's specimens. The pronotal disk of *campodeiformis* is figured and described as posteriorly truncate and with the preapical transverse sulcus of that plate straight, while this Californian specimen has the plate distinctly obtuseangulate behind and the transverse sulcus decidedly sinuate. But these apparent differences may be due to shrinkage of Walker's material. Another, and more striking difference is that the posterior femora of the 20 mm. long specimen from California measures 5 mm. in length while those of the 30 mm. long type of *campodeiformis* are stated to be but 3.4 mm.

In spite of the longer posterior femora, the forty segmented antennae and the other less important points of difference noted above, it is thought best to refer this Californian specimen to *campodeiformis*, though with considerable doubt. Its true status can be definitely determined only by direct comparison with specimens of the true *campodeiformis*, or by the accession of additional Californian material.

NOTES ON SOME DIPTERA

BY C. HOWARD CURRAN,

Ottawa, Ont.

Eucyrtopogon varipennis Coq. differs from all other species in the genus in having the third vein branched beyond the discal crossvein, and thus agrees in this character with *Cyrtopogon*. Notwithstanding this fact, I consider that it belongs in the first mentioned genus because of the structure of the antennae and general form. The enumeration of characters for *Eucyrtopogon* (antea, p. 95) should be amended by the insertion, at the conclusion of the sentence, line 12, page 95, of the following: "except in *E. varipennis* Coq."

Apicomyia Shannon. This Syrphid genus was proposed in "Insecutor Inscitiae Menstruus," Vol. X, p. 122, August, 1922. It is the same as *Cynorhinella* Curran, established in "Canadian Entomologist" LIV, p. 14, 1922. Shannon overlooked my genus.

Syrphus protritus O. S. . An examination of the type of this species and comparison with specimens of *S. nitidicollis* Mg. from Europe shows that *protritus* is a synonym of *nitidicollis*.

Odontomyia alberta Curr. is the same as *O. varipes* Loew.

(5). Can. Ent., vol. LI, p. 132, plate VIII, fig. 1, exp (1919).

Mailed June 25th, 1923

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The Canadian Entomologist

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TRAP-LANTERN RECORD AT ITHACA, NEW YORK (LEPIDOPTERA)

BY W. T. M. FORBES,

Cornell University, Ithaca, N. Y.

The present paper gives seasonal records at Ithaca, a typical locality in the Alleghanian (eastern Transition) zone, for the commoner species of Lepidoptera taken at light in a trap in the seasons of 1919 and 1922.

These two seasons give a fair representation of weather conditions in the region. 1919 was normal, though perhaps on the whole a little dry, and shows the usual tendency in west-central New York for a summer falling off of flights, many species having only a single brood in the late spring. On the other hand, 1922 was abnormally wet, and very steadily so, giving favorable conditions for a second brood in many species which were single brooded in 1919, and in general much heavier flights in the summer. Numerous species also appeared which are rarely taken at Ithaca, some of them in numbers.

It has seemed best to give the seasonal records in the form of plots. In each case the numbers of specimens caught were added together by weeks, and the height of the column for each week corresponds to the catch of that week. The vertical scale used in most cases is approximately .6 mm. per specimen. The following are given on half scale: *Diacrisia virginica, Feltia venerabilis, Agrotis bicarnea, Leucania luteopallens, Lithacodia carneola, Zanclognatha lituralis, Chytolita morbidalis* (1919), *Plathypena scabra* (1919), *Datana integerrima* and *contracta* (1922) *Heterocampa guttivitta* (1919), *Cleora cinctaria, Xanthotype crocataria, Phlyctaenia ferrugalis, P. terrealis, P. tertialis, P. perlextalis, P. fissalis, P. aeglealis, Galasa nigrinodis, Crambus alboclavellus, C. hortuellus* (1922), *C. albellus, Platyptilia pallidactyla, Metzneria lappella, Eulia velutinana* and *Gracilaria superbifrontella.* The following, on account of the large numbers captured, are plotted on still smaller scales: *Feltia ducens, F. herilis, Noctua baja* (1922), *Nephelodes emmedonia, Cirphis pseudargyrea,* (1922), *Epizeuxis aemula* (1922), *Zanclognatha jurcalis* group (1922), *Chytolita morbidalis* (1922), *Symmerista albifrons,* (plot by weeks), *Synelys cinctata* (1922), *Physostegania pustularia, Nepytia canosaria, Euranus subsignarius* (1922), *Nematocampa filamentaria, Sabulodes lorata* (1919), *S. transversata* (1922), *Evergestis straminalis* and *Crambus hortuellus* (1919).

In the Macrolepidoptera all the species of which ten or more specimens were taken in either year, are plotted; in the Microlepidoptera plots are only shown of a few of the commonest forms and the two years are not as a rule plotted separately, unless they showed some marked difference in time of flight.

In those cases where only one year justified a plot the dates of records on the other year are indicated by open circles.

The records for the middle part of the year are practically complete, though occasionally a few very rubbed specimens were not counted. The 1919 record was interrupted for about two weeks in September, and has been hypo-

thetically filled out on the graphs by a dotted area in the case of two or three fall species. In 1922 records were stopped in the middle of October. Mr. L. P. Wehrle cared for the trap in 1919, and Mr. Henry Good for the greater part of 1922. The latter also made the counts of the commonest species, saving all about which there was any question, for the writer. Aside from that, the writer is responsible for all determinations.

The total catch amounted to over 8,000 specimens in 1922, when a 500 watt tungsten light was used; in 1919, with a weaker light about 5,000 specimens were taken; but among them very few of the smaller Microlepidoptera.

The trap was located at the same spot both seasons, on the north slope of the Agricultural campus, so as to be protected from north winds by the woods, woods, but sending its light over a considerable area of open land on the top of the hill.

For convenience the list is arranged according to Barnes and McDunnough's List of Lepidoptera.

Complete records are preserved in the files of the Entomological department of Cornell University, as experiment 1030.

List of Captures

710 *Cressonia juglandis* Abbot and Smith. 27 specimens; one brood in June (Chart 1, 1919).

780 *Automeris io* Fabricius. 21; 1 brood in June. A single specimen on July 15, 1922 indicates an attempt at a second brood (Chart 1, 1919).

802 *Anisota rubicunda* Fabricius. 36; 1 brood in June (Chart 1, 1919).

856 *Crambidia pallida* Packard. 16; 1 brood in August. Strange to say, no Lithosiidae at all were taken in 1919. In 1922 there were also taken 8 *Hypoprepia fucosa* in July (Chart 1, 1922).

921 *Halisidota tessellaris* Abbot and Smith. 30; 1 brood in July. Only four of the specimens were taken in 1919, and all of these in June, before the usual summer drought came on. (Chart 1, 1922.)

953 *Diacrisia latipennis* Stretch. 26; 1 brood in June. Only two of these were taken in 1922 (Chart 1, 1919).

954 *Diacrisia virginica* Fabricius. In 1919: 56; one brood with climax at June 6, and 6 stragglers, representing the second brood. In 1922: 125; two broods with climax at June 6 and August 5. The differing history in the two years is striking, but is repeated in the case of *E. acraea, H. pseudargyrea, L. carneola* and several others. (Chart 1, 1919 and 1922.)

957 *Isia isabella* Abbot and Smith. In 1919: 12; one brood, with climax about June 17. In 1922: 13; one brood with climax June 7. This is the first of a number of late spring species that flew earlier in 1922, but the difference is not large (Chart 1, 1919 and 1922).

960 *Estigmene acraea* Drury. 1919: 21; one brood with climax June 17, and a couple of stragglers in August to represent the second brood. 1922: 35; two fully developed broods, the first straggling, but at its maximum late in May, the second in August. (Chart 1, 1919 and 1922).

1307 *Feltia venerabilis* Walker. 45; one brood in September. This was not taken at all in 1919, but a small flight may have been missed when the trap was not running. (Chart 1, 1922.)

1402 *Feltia ducens* Walker. 103; one brood in August. (Chart 1, 1922.)

1403 *Feltia subgothica* Haworth (*tricosa*). 15; one principal flight, in July, and a smaller one in August. The specimens were of the more typical form with base of hind wing markedly pale. The charts would suggest that this species is double brooded and *herilis* is a partially seasonal form, but it hardly seems possible, considering the slow rate of growth of most cutworms. The life history of this group needs investigation. (Chart 1, 1922).

1404 *Feltia herilis* Grote. 1919: 16; one brood with a few early stragglers. 1922: 92; one well marked brood, with climax August 23, and a small early flight with *F. subgothica*. (Chart 1, 1919 and 1922.)

1424 *Agrotis c-nigrum* Linnaeus. 64; three flights, with climax about July 8, August 18 and September 18. Only two broods are to be expected, and the meaning of the double flight in the fall is not clear. The few specimens in 1919 almost all belonged to the first brood. (Chart 1, 1922.)

1425 *Agrotis bicarnea* Guenee. 36; one brood in August. This species and the following were also rare in 1919. They presumably æstivate in the larva like *A. baja*, and have no early summer flight at all under central New York conditions. (Chart 1, 1922.)

1428 *Agrotis normaniana* Grote. 23; one brood in August, like the preceding and following. (Chart 1, 1922.)

1430 *Noctua baja* Fabricius. 70; the damp summer seems to have been favorable and to have brought it out of æstivation a week early in 1922. (Chart 2, 1919 and 1922.

1750 *Polia* (*Mamestra*) *renigera* Stephens. 24; flight irregular, from May to October. The contrast between this species (the bristly cutworm) and *P. lorea* is striking. Presumably there is more than one brood, but nothing can be proved by the graph. (Chart 2, 1922.)

1754 *Polia* (*M.*) *lorea* Guenee. 55; one brood at end of June. The different flight curves for the two years have no obvious meaning. (Chart 2, 1919 and 1922.)

1798 *Chabuata signata* Walker. 18; one brood in August. Only two specimens were taken in 1919. (Chart 2, 1922.)

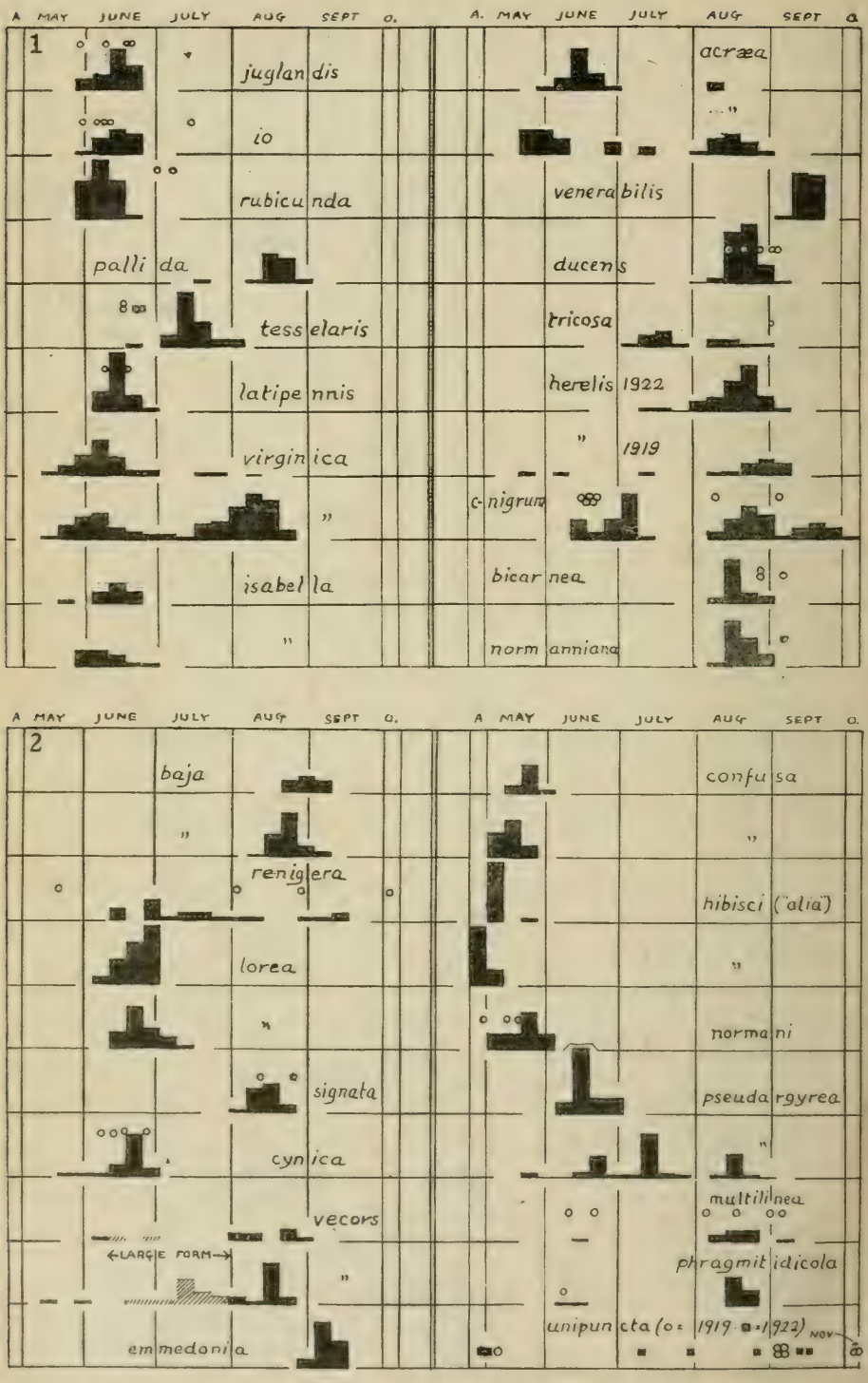
1839 *Eriopyga cynica* Guenee. 22; one brood in June. (Chart 2, 1922.)

1842 *Eriopyga vecors* Guenee. 1919: 11; flight irregular. The two later June specimens were of the well marked large form that formed the summer brood in 1922. 1922; 31; two broods, and early stragglers of the autumn form. The summer brood is much larger than spring and fall specimens. This species has been bred by Mr. Wehrle, and is a cutworm in habits. Its life history should be interesting. (Chart 2, 1919 and 1922.)

1866 *Nephelodes emmedonia* Cramer. 58; one brood in September. The time of flight comes when the trap was not running in 1919 (Chart 2, 1922).

1878 *Morrisonia confusa* Hubner. 28; one brood in May. (Chart 2, 1919 and 1922.)

1919 *Orthosia hibisci* Guenee (*Graphiphora alia*). 1919: 17; one flight with climax on May 4. 1922: 19; climax on April 25. The difference in the two years may not be significant as in 1922 the trap was not running efficiently in April (Chart 2, 1919 and 1922.)



TRAP LANTERN RECORDS.

1927 *Sideridis normani* Grote. 24; one brood with climax May 22. Only three specimens appeared in 1922. (Chart 2, 1919.)

1933 *Cirphis pseudarygria* Guenee. 1919: 27; one brood in June. 1922: 90, three flights with climax about June 20, July 15 and August 18. The contrast in the two seasons is striking. The July flight in 1922 was wholly of dwarf specimens, the August flight practically normal. (Chart 2, 1919 and 1922.)

1934 *Cirphis multilinea* Walker. 16; one well marked brood in August, and indications of another in June. The numbers are too small to be significant. (Chart 2, 1922.)

1936 *Cirphis phragmitidicola* Guenee. 14; principal brood in August. Again three June specimens would point to an early brood. (Chart 2, 1922.)

1950 *Cirphis unipuncta* Haworth. The very few specimens taken (14 in all) are extraordinarily scattered. The indication of hibernation in the imago is plain, as the early specimens are rubbed. The species also hibernate in the larva, and I understand, other stages. There are supposed to be about two broods. (Chart 2, 1919-1922.)

1972 *Leucania luteopallens* Smith. 65; two broods, in June, and in August and September. In this case the June brood is the principal one, and the fall brood is presumably partial. (Chart 3, 1919 and 1922.)

2216 *Conistra indirecta* Walker. 18; one brood in October to May. (Chart 3, 1919.)

2220 *Amathes bicolorago*, form *ferrugineoides* Guenee. 58; one brood in late fall. (Chart 3, 1922 plotted.)

2239 *Amphipyra pyramidoides* Guenee. 16; presumably one brood from August to October. (Chart 3, 1922.)

2291 *Trachea finitima* Guenee. 47; one brood in June. (Chart 3, 1919 and 1922.)

2327 *Perigea vecors* Guenee. 33; one flight, with climax about August 6. This species is suspected of being migrant, and some of the specimens may be from the south. It was not taken in 1919. (Chart 3, 1922.)

2344 *Agroperina dubitans* Walker. 75; one brood, with climax about August 10. The heavy flight was presumably due to the favorable season of 1922; the species is not common at Ithaca. (Chart 3, 1922.)

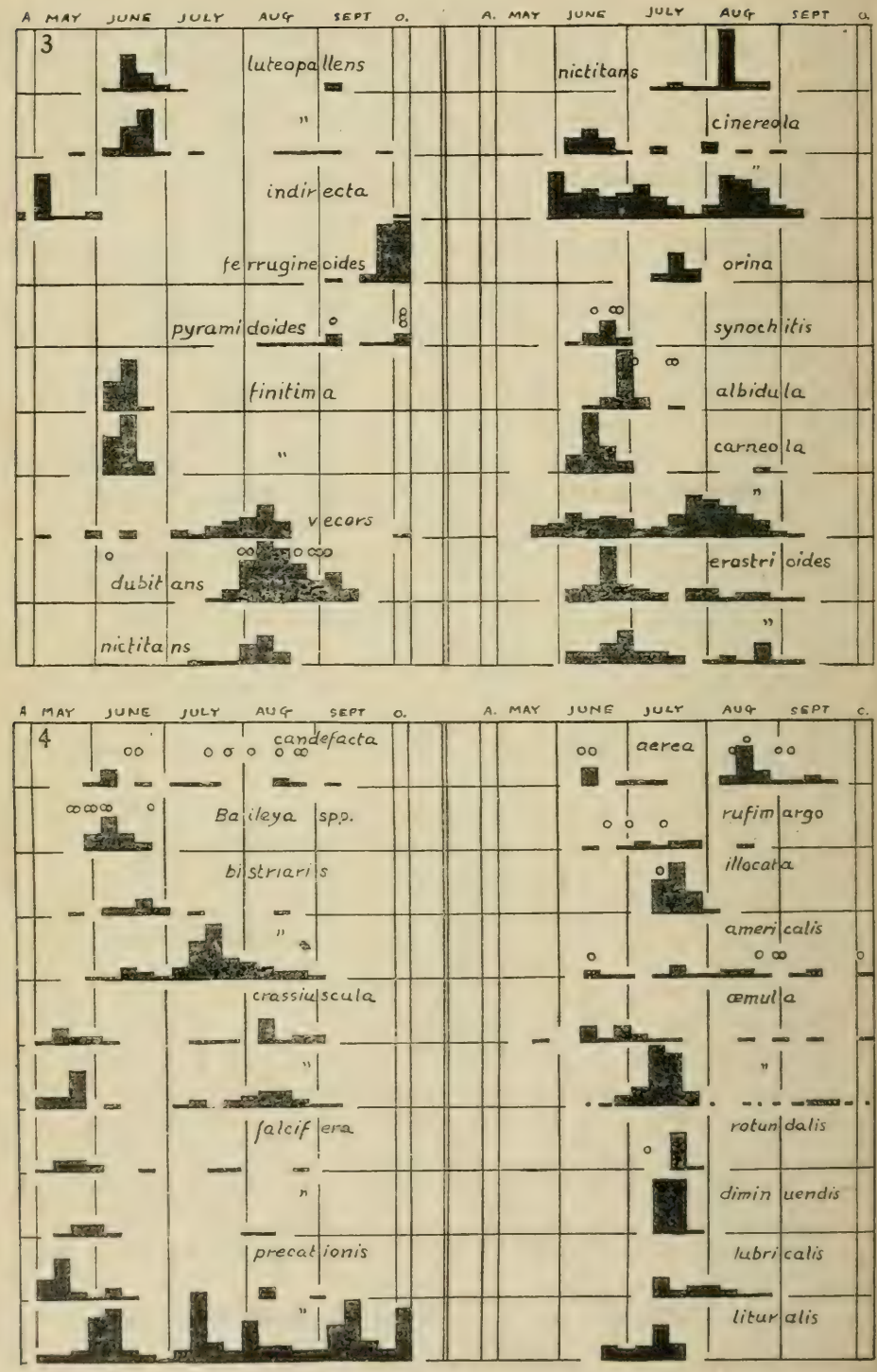
2638 *Apamea nictitans* Linnaeus. 42; one brood, with climax about August 10. (Chart 3, 1919 and 1922.)

2704 *Ogdoconta cinereola* Guenee. 1919: 22; one well marked brood in June and stragglers in midsummer. 1922: 86; two broods, the first very heavy in June and most of July, the second in August. (Chart 3, 1919 and 1922.)

2735 *Cosmia orina* Guenee. 12; one brood in July (not taken in 1919) (Chart 3, 1922.)

2894 *Lithacodia synochitis* Grote and Robinson. 13; one brood in June (Chart 3, 1919.)

2895 *Lithacodia albidula* Guenee. 29; one brood, with climax June 29. In warmer regions the flight continues through August, and there are doubtless two broods. (Chart 3, 1919.)



TRAP LANTERN RECORDS.

2900 *Lithacodia carneola* Guenee. 1919: 67; one brood in June and 7 stragglers in July and August. 1922: 154; two broods, with climax in June and about August 1. The large numbers of this species make the extreme contrast between the two years more significant. (Chart 3, 1919 and 1922.)

2952 *Tarachidia erastrioides* Guenee. 79; two broods, at end of June and in August. The second brood is relatively heavier in 1922, but the contrast with the preceding species is striking. (Chart 3, 1919 and 1922.)

2956 *Tarachidia candefacta* Hubner. 22; flight irregular, presumably indicating two broods like *erastrioides*. (Chart 4, 1922.)

301- *Baileya* species. 24; one flight in June (Chart 4, 1919.)

3127 *Parallelia bistriaris* Hubner. 63. There would appear to be a light spring brood in June, which in 1922 was followed by a heavy second brood in July; but the flight record is not clear. (Chart 4, 1919 and 1922.)

3136 *Caenurgia crassiuscula* Haworth. 61; two broods, in May and August. As it is well known the first brood is undersized. A few specimens of *erechtea* may have been included; but the flights of the two are identical anyway. (Chart 4, 1919 and 1922.)

3230 *Autographa falcifera* Kirby (including *simplex*). 23; one well-marked brood in May and stragglers later. There are supposed to be two or three broods. (Chart 4, 1919 and 1922.)

3261 *Autographa precationis* Guenee. 1919: 30; one well marked brood in May and stragglers in July. 1922; 132; five distinct flights, presumably representing three broods; climaxes about June 7, July 10, August 1, Sept. 10 and October. This species obviously took advantage of the favorable season to increase enormously. (Chart 4, 1919 and 1922.)

3276 *Plusia aerea* Hubner. 32; two flights, in June and August. (Chart 4, 1922.)

3352 *Panapoda rufimargo* Hubner. 13; apparently one brood in midsummer (Chart 4, 1922.)

3475 *Dyspyralis illocata* Warren. 27; one flight in July. This and the following Herminiine deltoids hardly occurred at all in 1919; apparently the wet weather of 1922 agreed with them. Most of the few larvae known feed on dead leaves in damp woods. I think this note is the first published on the seasonal history of the majority.

3485 *Epizeuxis americalis* Guenee. 24; straggling along all summer. (Chart 4, 1922.)

3486 *Epizeuxis aemula* Hubner. 1919: 18; one well marked brood in June, followed by a few stragglers. 1922: 185; a heavy brood in July and a partial second in September. Evidently this species took advantage of the moist July for an enormous increase; the second brood may have been missed in 1919. (Chart 4, 1919 and 1922.)

3490 *Epizeuxis rotundalis* Walker. 11; one brood in July. (Chart 4, 1922.)

—— *Epizeuxis diminuendis* Barnes and McDunnough. 27; one brood in July. (Chart 4, 1922.)

3496 *Epizeuxis lubricalis* Geyer. 17; one brood in July and August. The straggling flight of this species is in contrast with the concentrated seasons of the last two.

3499 *Zanclognatha lituralis* Hubner. 43; one brood, centering about July 10. (Chart 4, 1922.)

3502 *Zanclognatha inconspicualis* Grote. 33; one brood, about July 10. (Chart 5, 1922.)

3503 *Zanclognatha laevigata* Grote. 58; one brood in July. All the named forms and some others were represented.

3506 *Zanclognatha pedipilalis* Guenee. 41; one brood in June. This species is markedly earlier than the *jacchusalis* group in both years. (Chart 5, 1919 and 1922.)

(To be continued.)

SAWFLIES FROM ALBERTA (TENTHREDINIDAE)*

BY ALEX D. MACGILLIVRAY,
Urbana, Ill.

The following new species constitute a part of a collection of saw-flies, Tenthredinidae, received from Mr. A. M. Wolcox of Wellesley, Massachusetts. The specimens were all collected at Edmonton, Alberta, Canada, by Mr. F. S. Carr. There is a surprising number of new species in the collection, particularly for one of its size. When many more specimens are available from this region, some or all of the nematids described as new may prove to be the same as some of the species described by Norton from the Mackenzie River region. The types of all these species unfortunately are lost.

Empria cava MacG.

Empria cadurca n. sp.

Female. Body black with the margin of the pronotum white and the front legs beyond the middle of the femora and the other legs beyond the knees, yellowish-white; antennae with the third segment longer than the fourth, the fourth and fifth subequal; the clypeus emarginate, clypeal tooth pointed, clypeal lobes long, angular; supraclypeal area convex; ocellar basin long, narrow, and deep; median fovea a round pit; vertical furrows deep, linear; postocellar area distinct; saw-guides broad, bluntly truncately rounded; wings slightly smoky, veins and stigma and costa black, setae distinct. Length, 6 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species is related to *cava*, from which it is easily separated. The male does not differ from the female.

Dolerus nuntius n. sp.

Female. Body black with abdominal segments one to five rufous; the knees and front tibiae in certain lights with a rufous shading; antennae with the third segment longer than the fourth, the fourth and fifth subequal; front and facial orbits finely densely punctate, finer and more densely than on the postocellar area and vertical orbits, furrow behind compound eyes present only adjacent to eyes, transverse furrow adjacent to occiput indicated; vertical furrows distinct, elongate; median lobe of mesonotum with each lateral half densely punctate, mesal portion and lateral lobes uniformly punctate; mesoscutellum coarsely punctate; scutellar appendage longitudinally striate; saw-guides broad,

*—Contributions from the Entomological Laboratories of the University of Illinois No. 81.

obliquely truncate; wings smoky, veins and costa black; stigma partly pale. Length 7 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species is related to *nectareus*.

Dolerus nutricius n. sp.

Male. Body black with abdominal segments one to six and the tibiae, rufous; antennae with the third and fourth segments subequal, the fourth longer than the fifth; the front and facial orbits uniformly densely punctate, the postocellar area not so densely punctate, vertical orbits with a polished area; median lobe of mesonotum with each lateral third densely punctate, median third with small sparse punctures; lateral lobes of the mesonotum polished, almost impunctate; scutellum punctate; mesoscutellar appendage longitudinally striate; wings smoky, veins, stigma and costa black. Length 6 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species is near *nectareus* and *nuntius*.

Dolerus nummatus n. sp.

Female. Body black with the pronotum in part, tegulae, abdominal segments one to five, front tibiae, and the knees and more or less of the middle legs; antennae with third segment longer than the fourth, the fourth and fifth subequal; the front and facial orbits coarsely punctured, postocellar area more or less corrugated, vertical orbits with a transverse impunctate area; transverse furrow limited adjacent to compound eyes, the transverse furrow adjacent to the occiput distinct; mesonotum sparsely generally punctate, each lateral third of median lobe more densely punctate than the median portion; mesoscutellum punctate; the appendage of the mesoscutellum longitudinally striate; saw-guides broad, stout, obliquely truncate; wings hyaline, spinulae distinct, veins and costa blackish, stigma partly pale. Length 8 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species belongs near *nocivus*.

Dolerus nundinus n. sp.

Male. Body black with abdominal segments one to five rufous; antennae with third, fourth, and fifth segments subequal; front and facial orbits finely densely punctate; postocellar area not so densely punctate and vertical orbits polished with a few large shallow punctures; mesonotum punctate, sparsely except each lateral third of median lobe which is closely punctate; mesoscutellum coarsely punctate; scutellar appendage longitudinally striate; wings hyaline, veins and costa and stigma black. Length, 7 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species is related to *nemorosus* and *negotiosus*.

Dolerus nummarius n. sp.

Female. Body black with abdominal segments one to five and the knees of the first pair of legs rufous; antennae with the third segment longer than the fourth, the fourth longer than the fifth; front and facial orbits finely densely punctate, postocellar area not so densely; vertical orbits with polished area with coarse punctures, a short furrow adjacent to each compound eye, and a small furrow along the caudal margin of the head; mesonotum punctate, median lobe

densely, particularly each lateral third, disk of lateral lobes polished with fewer punctures; mesoscutellum punctate, scutellar appendage longitudinally striate; saw-guides broad, obliquely truncate; wings slightly smoky with the veins and stigma and costa black. Length, 8 mm.

Habitat:—Edmonton, Alberta; F. A. Carr, collector. This species falls

Pacyprotasis rapae Linnaeus.

Rhogogastera evansii Harrington.

Rhogogastera ruga n. sp.

Female. Body greenish-yellow with the following parts black: An oval area surrounding the ocelli and not including the ocellar areas, the caudal aspect of the head, except the peripheral portions, the lobes of the mesonotum except wedge-shaped marks on the median and two on each lateral lobe, the scutellum, and the metascutellum, a broad transverse band on the basal plates and abdominal terga one to seven, and the margins of the saw-guides; the legs beyond the coxae, except the tarsi, with a black line above, the posterior coxae above, and a ring on the distal end of each tarsal segment; clypeus narrowly deeply emarginate, clypeal lobes comparatively broad; antennal plates small and inconspicuous, ocellar basin shallow, ocellar areas broad; postocellar area distinct; antennal furrows continuous; antennae with the third segment longer than the fourth, the fourth longer than the fifth; saw-guides broad, stout, dorsal margin straight, ventral and distal margins convex; wings hyaline, costa and stigma greenish, veins black. Length 10 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species is related to *respectus*.

Tenthredo erythromera Provancher.

Tenthredo nigrisoma Harrington.

Tenthredo scaevola Cresson.

Tenthredo rutila n. sp.

Female. Body black with the following parts yellow: The clypeus, labrum, mandibles, tegulae, spot above the posterior coxae, front legs beyond the trochanters, the middle legs beyond the coxae except a spot on the apices of the femora, and the hind legs beyond the trochanters except a band on the upper side of the femora, the distal end of the tibiae, and most of the tarsi; abdominal terga and sterna yellowish-rufous; clypeus broadly emarginate; ocellar basin broad and deep; postocellar area quadrangular; antennae with the third segment longer than the fourth, the fourth longer than the fifth; the lobes of the mesonotum punctate; saw guides straight above, bluntly rounded below; wings slightly smoky with the veins and the stigma and the costa black. Length, 11 mm.

Habitat—Edmonton, Alberta. This species is very similar in general appearance to *bifasciata* Say.

Tenthredo rumina n. sp.

Female. Body black with the following parts yellow: the clypeus, labrum, mandibles, pedicel of antennae, indefinite marks on occipital orbits, collar, tegulae, scutellum, spot above posterior coxae, basal plates for the most part, front legs beyond the coxae except the distal half of the femora, a ring

on the tibiae, and their tarsi above, more or less; abdomen with the tergum and sternum of the fourth segment rufous, terga of the sixth and seventh segments with lateral yellow marks, and the eighth segment wholly yellow; clypeus narrowly emarginate; antennal plates distinct, black, not large; ocellar basin almost wanting, a fovea adjacent to the median ocellus; antennal furrows distinct; antennae with the third segment longer than the fourth, the fourth longer than the fifth; saw-guides convexly rounded on dorsal and ventral margins; wings smoky, costa and stigma pale, veins blackish. Length, 10 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species is very similar to *Allantus basilaris* Say.

Abia kennicotti Norton.—A male specimen agrees perfectly with the description of Norton.

Cimbex violacea St. Fargeau.—A single female specimen that agrees with the description of W. F. Kirby. It is not a distinct species but a variety of *Cimbex americana* or *Cimbex pacifica*. There have not been sufficient specimens examined to answer the question, but it looks as if the two species of Cresson, *rubida* and *pacifica*, were southern and northern forms of the same species respectively. *Pacifica* occurs in north-west Canada and is probably only an extreme variety of the eastern *americana*. If *semidea* should prove to be only a variety of *americana*, there would then be only a single species of *Cimbex* in North American with a long series of very different varieties.

Trichiosoma confundum n. sp.

Female. Body black with the abdomen beyond the first segment and the legs beyond the femora, rufous; antennae with the third segment elongate, longer than four and five together, segments six and seven distinctly separated, seventh marked near distal end with an inconspicuous suture; head and thorax densely covered with long grayish setae, abdomen nearly bare or with very short setae; clypeus broadly emarginate; labrum blunt, bluntly rounded, setiferous; saw-guides broad, bluntly rounded, apex at middle; wings infuscated, costa and veins yellowish, stigma black. Length, 12 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species runs to *confusum*.

Blennocampa amara n. sp.

Female. Body black with the labrum, clypeus, collar, tegulae, and legs beyond the middle of the femora, yellow; antennae with the third segment longer than the fourth, the fourth and fifth subequal; clypeus truncate; median fovea a broad shallow depression; lateral foveae not sharply marked, continuous with the antennal furrows; ocellar basin represented by a depression below the median ocellus; postocellar area limited, interocellar suture distinct; mesonotum polished; saw-guides broad, obliquely truncate, dorsal margin straight; wings infuscated, veins and stigma and costa black. Length, 4 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species runs to *abnorma*.

Pteronidea egeria n. sp.

Female. Body black with the following parts shading from white to rufous: the clypeus, labrum, mandibles, genal orbits, continued as a line on to

occipital orbits, and irregularly expanded on vertical orbits, collar, edge of tegulae, front and middle legs beyond the middle of the femora, and the knees and tibiae of the posterior legs; clypeus roundly emarginate, clypeal lobes rounded; median fovea elongate, deep; frontal crest short, stout, unbroken; walls of pentagonal area broadly rounded, ocellar basin shallow, deepest near frontal crest; saw-guides stout, ventral margin oblique, bluntly rounded; wings hyaline, costa and stigma pale, veins blackish. Length, 7 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species is near *pacificus*.

Pteronidea egnatia n. sp.

Female. Body black with the following parts white, on some parts suffused with rufous: the clypeus, labrum, mandibles, supraclypeal area, a band on all the orbits, expanded on the vertical orbits, angles of pronotum, tegulae, spot on mesopleura, sterna of abdomen, tergum of caudal segment, and the legs except the hind tarsi more or less; antennae with the third segment longer than the fourth, the fourth and fifth subequal; clypeus deeply emarginate, clypeal lobes rounded; median fovea large, deep, extending through and dividing the frontal crest; walls of the pentagonal area distinct; saw-guides with converging margins, bluntly pointed; wings hyaline, costa and stigma pale, veins blackish. Length, 8 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species is related to *hyalinus*.

Pteronidea elelea n. sp.

Female. Body yellowish with an imperfect black spot about ocelli, a small spot on each lateral lobe of the mesonotum, an elongate oval dot on each side of the meso scutellum, and a line in the suture at the caudal margin of the metascutellum and the basal plates; the antennae irregularly fuscous above, the third and fifth segments subequal in length, the fourth longer; the clypeus broadly and shallowly emarginate; median fovea broad with sloping sides; frontal crest distinct, broadly, slightly broken; walls of pentagonal area distinct; ocellar basin deep, triangular; saw-guides elongate, oblique, bluntly pointed; wings hyaline, costa and stigma pale, veins blackish. Length, 7 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species is similar to *mendicus* but lacks much of the black found on specimens of this species.

Pachynematus allegatus n. sp.

Female. Body black with the following parts yellowish: The clypeus, labrum, mandibles, supra-clypeal area, occipital and vertical orbits, more or less rufous, angles of pronotum, tegulae, abdomen above beyond first segment and sternum except saw-guides, and legs; antennae with the third and fourth segments subequal, longer than the fifth; clypeus deeply emarginate, clypeal lobes broadly rounded; median fovea deep, longer than broad; frontal crest strongly elevated, unbroken; walls of pentagonal area sharp, ocellar basin flat, pentagonal; saw-guides stout, strongly projecting, oblique and truncated; wings hyaline, costa and stigma pale, veins blackish. Length, 7 mm.

Habitat:—Edmonton, Alberta; F. S. Carr, collector. This species is related to *punctulatus*.

NEW CANADIAN LEPIDOPTERA*

BY J. McDUNNOUGH,

Ottawa, Ont.

Euxoa dodi sp. nov.

Primaries narrow, rather even gray (in older specimens with a brownish tinge) with clear cut maculation; usual lines black, geminate, pale-filled; basal half-line dentate, t. a. line straighter than usual, almost perpendicular to inner margin, with slight inward angles of the outer line on the cubitus and vein 1; claviform a long black loop, orbicular oval, almost round, partially outlined in black with filling slightly paler than ground color, reniform broad, stumpy, not much excavated on outer margin, outlined in black; t. p. line excurved below costa, then inwardly oblique and dentate; s. t. line pale, irregular, emphasized by the terminal area which is darker than the remainder of wing; at times slight black triangles precede the s. t. line in its central portion; a broken black terminal line; fringes with a pale ochreous basal line followed by a smoky one, remainder pale smoky. Secondaries whitish with a smoky tinge and traces of a darker terminal band. Expanse 30-32 mm.

Holotype—♂, Lethbridge, Alta., Aug. 17, 1915, (E. H. Strickland), No. 608, in the Canadian National Collection, Ottawa.

Allotype—♀, Lethbridge, Alta., Aug. 23, 1915, (E. H. Strickland), in the Canadian National Collection, Ottawa.

Paratypes—2 ♂, Lethbridge, Alta., Aug. 27, 1922, (H. L. Seamans); Calgary, Alta., Aug. 16, 1901, (F. H. Wolley-Dod).

The species is apparently rare as the above four specimens represent the total catch over a period of more than 20 years. The Calgary specimen bears labels doubtfully identifying it as *difformis* Sm. or a pale variety of *intrita* and in the Dod Collection, as it came to us, was placed under *mercedes* B. & McD. Mr. Benjamin, to whom specimens were submitted, could not satisfactorily place it by comparison with species in the Barnes Collection. It may eventually prove to be one of Smith's obscure species, but in the meantime, it seems best to give it a definite name.

In the male genitalia the inner branch of the harpe is three-fifths the length of the outer branch, and heavily clothed with short hairs; the outer branch tapers to a point, is slightly curved apically and reaches to about the level of the apex of the clasper, which is rather slender and narrow; the eversible membrane of the aedoeagus shows a small chitinous tooth.

Euxoa clausa sp. nov.

Primaries light olivaceous-ochreous, paler along costa and slightly shaded with smoky. Maculation distinct, practically identical with that of *idahoensis* but generally better defined. A black basal streak, a black t. a. line with a prominent outward bulge above inner margin; claviform a black loop, orbicular oblique, pale-filled, reniform smoky, outlined by a pale line, edged with black; cell around and between spots slightly tinged with smoky; t. p. line black, generally quite distinct, bent outwards below costa, then inwardly oblique and dentate; s. t. line pale, irregular, preceded by black arrow-marks; a broken terminal

*—Contribution from Division of Systematic Entomology, Entomological Branch, Dept. of Agriculture, Ottawa.

black line; fringes pale smoky with ochreous line at base. Secondaries light smoky in both sexes with distinct discal lunule.

Holotype—♂, Lethbridge, Alta., July 21, (E. H. Strickland; No. 598, in the Canadian National Collection, Ottawa.

Allotype—♀, Lethbridge, Alta., July 15, (E. H. Strickland); in the Canadian National Collection, Ottawa.

Paratypes—1 ♂, Lethbridge, Alta., July 5, (E. H. Strickland); 1 ♂, Lethbridge, Alta., July 19, (H. L. Seamans); 2 ♀, same locality and collectors, July 17 and 26.

The peculiar olivaceous tinge on the primaries separates *clausa* from the gray forms of *idahoensis*, of which, however, it may be merely a semi-desert form. I have only seen the species from Lethbridge, where typical *idahoensis* also occurs and is readily separable. In the male genitalia the clasper of *clausa* is narrower and slightly longer than that of *idahoensis* and the forks of the harpe are more slender, especially the outer one at the base, giving the harpe a more even U-shaped appearance. I use a manuscript name, given by the late F. H. Wolley-Dod, who had tentatively separated off two specimens in his collection.

PYRALIDAE

Crambus edmontellus sp. nov.

Male. Very similar to *laciniellus* Grt. but slightly larger, less evenly ochreous in color and with the outer margin of primaries decidedly more bulging below the apex of wing. Primaries pale to dark ochreous; with the exception of the basal half of the costal area this color is generally hidden by a heavy sprinkling of grayish-white scales mingled with a few blackish ones; at times the blackish scales predominate, producing a much darker appearance. Vein 1 and the cubital vein ochreous and prominent across the pale areas; other veins beyond the cell whitish with similarly colored parallel interspaceal lines, giving a more distinct striate appearance to the outer wing area than is found in *laciniellus*. Traces of cross lines as in *laciniellus*, i. e., a very oblique brownish streak above the inner margin at middle and a more distinct brown sub-terminal line, outcurved below costa, prominently angled on vein 2 and bulging outwardly above anal angle. Three or four faint black terminal dots just below veins 2—5. A whitish, slightly shining line at base of fringes; remainder duller and darker in color, composed of an admixture of white and pale brown scales. Secondaries pale, considerably suffused with smoky in outer half; fringes white, cut by a smoky line at base. Expanse 25 mm.

Female. What I take to be the female of the species is considerably larger and paler than the male, the primaries being whitish, suffused with light ochreous and with indistinct maculation. The secondaries are almost pure white. Expanse 30 mm.

Holotype—♂, Edmonton, Alta., July 26, (K. Bowman); No. 597, in the Canadian National Collection, Ottawa.

Allotype—♀, N.W.T., 1907, (J. Fletcher); in the Canadian National Collection.

Paratypes—4 ♂, Edmonton, Alta., July 14, 18, 28, Aug 1, (K. Bowman); 1 ♂, Calgary, Alta., July 5, (K. Bowman); 1 ♂, 1 ♀, Lethbridge, Alta., June 29, 30, (H. L. Seamans); 2 ♂, 2 ♀, N.W.T., 1907, (J. Fletcher); all in the

Canadian National Collection except the first mentioned, which is in Collection Bowman.

The ♂ genitalia are distinct from those of *laciniellus;* in this latter species there is a well developed accessory spine at the base of the harpe, which in *edmontellus* is very greatly reduced.

EUCOSMIDAE

Argyroploce dextrana sp. nov.

Male. Very similar in color to *removana* but with dark banding of primaries better defined, due to white scaling in antemedian and terminal areas. The thoracic tuft is not brown-tipped nor is there a brown patch of scaling at base of primaries. A distinct quadrate dark patch on costa near base, the edges continued across wing by waved dark lines; beyond this patch the costal area up to the median dark band is noticeably paler; median dark band indistinct, very irregular, contracted below costa, angled inward on the submedian fold, partially defined on inner area of wing by fine black lines, which are entirely lacking in *removana;* a thin curved dark band, defined by black lines from middle of outer margin towards costa but not attaining same; remainder of terminal area lightly sprinkled with white. Secondaries pale, shading into smoky outwardly.

Female. The single female before me shows a dark shade extending along inner half of wing from base to median band and defined towards costa by a streak of deeper shade. Expanse 17—19 mm.

Holotype—♂, Ottawa, Ont., July 28, (C. H. Young); No. 595, in the Canadian National Collection, Ottawa.

Allotype—♀, Ottawa, Ont., Aug. 5, (C. H. Young); in the Canadian National Collection, Ottawa.

Paratypes—2 ♂, Calgary, Alta., July 27, (F. H. Wolley-Dod); Edmonton, Alta., Aug 12, (K. Bowman).

The ♂ genitalia are very similar to those of *removana* but the claspers are considerably broader apically, the ventral spined projection of the sacculus is longer and broader and the cornutus is noticeably longer and contains a slight lateral projection.

Argyroploce bowmanana sp. nov.

Primaries deep black-brown with paler bands and lines of a leaden colour and a prominent round white blotch at end of cell. Basal area leaden colored with a dark brown perpendicular line near base not reaching costa; this area is bordered by a black-brown band, outwardly oblique from costa to below cell, then almost perpendicular to inner margin, with a slight notch in its outer margin in submedian fold, broader at inner margin than at costa; beyond this dark band is the usual antemedian pale band, composed of leaden scales with a broken line of dark scales through its centre; a median dark band of even width throughout with a sharp hook-like projection on its outer side in the cell, above which rests a round white spot; below the hook is an area of leaden scales separating the median band from an oblong dark blotch on inner margin before tornus; this blotch almost touches a similarly-colored larger blotch, descending from costa before apex and formed by the union of lines arising from two small dark costal spots; above the white spot are two similar dark costal spots and the apex

of the wing contains a small, round, dark patch; a small dark patch on outer margin above tornus, the area between these dark patches being filled in with leaden or silvery scaling; fringes largely smoky with paler admixture at apex and tornus. Secondaries deep smoky with paler fringes. Expanse 15 mm.

Holotype—♂, Nordegg, Alta., (alt. 6000 ft.) July 23, (K. Bowman); No. 607, in the Canadian National Collection, Ottawa.

Paratype—♂, same date and collector, in the Canadian National Collection.

I take pleasure in naming this species after the collector, Mr. K. Bowman, of Edmonton, who has kindly donated the specimens to the Canadian National Collection.

TORTRICIDAE

Homona negundana sp. nov.

Primaries pale shiny ochreous crossed by median and subapical bands of a deeper brownish color. Some slight dark scaling at base of wing, giving the appearance of an obsolescent brownish basal patch; the brown median band is oblique from middle of costa to anal angle; on the outer side in the cell it sends a short projection upward toward costa and on inner side obliquely opposite this is a downward projection toward the basal dark area; in the fold this median band is much narrowed, expanding again at anal angle to a large blotch. The subapical band commences broadly at costa just before apex of wing and gradually narrows to a point on outer margin just above anal angle. The pale areas show more or less evident brownish striations. Fringes concolorous. Secondaries pure white. Expanse 18 mm.

Holotype—♂, Aweme, Man., June 19, (N. Criddle); No. 599, in the Canadian National Collection, Ottawa.

Paratypes—2 ♂, Aweme, Man., June 23, 27, (N. Criddle); 2 ♂, Winnipeg, Man., June 8.

The species was bred from larvae on *Acer negundo* by Mr. Criddle, but should not be confused with the somewhat similar *Cacoecia negundana* Dyar. The stalking of veins 7 and 8 of primaries at once separates it from this latter species.

Around *Cacoecia argyrospila* Wlk. are grouped several forms, agreeing closely in general type of maculation and showing no decided differences in the male genitalia; these forms seem to be closely associated with certain larval food plants, that is to say, a series of specimens bred from larvae taken on the same food plant resemble each other very closely and differ from series bred from larvae taken on other plants. In Manitoba, for instance, Mr. N. Criddle has found what seems to be typical *argyrospila* feeding on Poison Ivy whilst from larvae on *Eleagnus* he has bred a series of specimens that can be readily distinguished from the poison ivy form. Such distinctive forms seem to my mind worthy of a name and for the Eleagnus form I propose the name:

Cacoecia eleagnana sp. nov.

Similar in maculation to *argyrospila*, but with the primaries much paler in color, due to the fact that the red-brown scaling is replaced by scales of a light olive-brown or olive-green; the pale costal spot beyond the median band is prominent and the pale areas between the bands show a decided silvery sheen in certain lights, more so than is usually present in *argyrospila*.

Holotype—♂, Aweme, Man., July 7, (N. Criddle); No. 600, in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—9 ♂, 1 ♀, same data.

I have before me similar specimens from Calgary, Alta., and Lethbridge, Alta., where Elaeagnus also abounds; *argyrospila* also occurs at Lethbridge in the form *vividana* Dyar, described from Colorado material bred from larvae on Rubus.

Another even more distinct form than *elaeagnana* was bred by me in the summer of 1922 at Algonquin Park, Ontario, from larvae found in numbers on *Myrica gale*. For this I suggest the name:—

Cacoecia myricana sp. nov.

Male. Maculation of primaries very similar to that of *argyrospila* but neater and better defined, due to the fact that the paler areas are not so suffused with brown reticulations and shades; the dark areas are deep red-brown, much as in *argyrospila*, the median band being rather cleanly cut and generally distinctly broken above the anal angle; the dark costal spot near apex is very distinct and is not connected with the median band; there is scarcely a trace of an oblique band running upwards from outer margin above anal angle. The costal spots are well silvered and this silvering extends at times over the entire pale portion of the wing producing a very striking and beautiful appearance.

Female. The two females before me have the primaries almost unicolorous red-brown with the dark banding scarcely noticeable and the pale costal spots absent.

Holotype—♂, Algonquin Park, Ont., July 4, (J. McDunnough); No. 601 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—8 ♂, 1 ♀, same data.

Cacoecia columbiana sp. nov.

Female. Palpi upturned, appressed, short, ochreous; thorax and primaries light yellow, latter with a few chestnut-brown striations at base; a broad chestnut-brown oblique band from costa before middle to anal angle, broadening out below cell, narrowed above inner margin by a tooth of ground color jutting in from basal side; an oblong chestnut-brown costal spot beyond this band, connected narrowly with same and enclosing a pale yellow spot; fringes concolorous. Secondaries pale smoky, ochreous toward apex. Beneath pale ochreous with an irregular dull purplish blotch in the central portion of primaries; secondaries paler than above. Expanse 21 mm.

Holotype—1 ♀, Salmon Arm, B. C., July 17, (W. R. Buckell); No. 603, in the Canadian National Collection, Ottawa.

Similar in general type of color and maculation to *Tortrix fucana* Wlshm., which however, is placed by Meyrick (Gen. Insect. Fasc. 149, 30) in the genus *Tortrix*, characterized by longer, porrect palpi. The preapical costal spot is also much better defined in *columbiana* that in Walsingham's figure (Ill. Lep. Het. IV, Pl. LXIII, fig. 2) and not so close to the apex of wing.

Tortrix alberta sp. nov.

Male. Palpi intermediate between typical Cacoecia-like palpi [upturned

closely appressed, short) and Tortrix-like ones (porrect, second joint heavily scaled on upper side, longer); in the present species they are upwardly oblique, not heavily scaled and not closely appressed, blackish with a few pale scales. Head and thorax pinkish ochreous suffused with black. Primaries with distinct costal fold, pale ochreous with generally a slight pinkish tinge, suffused at the base and beyond the cell partially with red-brown, leaving a broad pale antemedian band, sharply defined on each side by a deep-brown, almost band-like line, composed of an admixture of black and red-brown scaling; the inner line is rather evenly convex and broadens towards inner margin, the outer line, from before mid-costa to beyond middle of inner margin, is slightly irregular, oblique, with generally an outward bend in the cell; it originates on the costa in a more or less well defined brown patch. From the bend of this outer line a dark band extends obliquely to costa, enclosing a large pale triangular spot on costa; in the cell this band is composed of leaden-gray scaling but at costa shows red-brown scaling, this color extending broadly along costa to apex and down outer margin to just above anal angle, enclosing on costa a small, pale pre-apical spot and several black dots; the pale area at the anal angle extends upwards into this brown area in the form of an inverted U, the edges in upper portion being partially outlined by a deep brown line; the pale areas show traces of dark striae; fringes ruddy with black basal dots. Secondaries whitish with numerous dark striae, thickest outwardly, and pale pinkish fringes. Expanse 26 mm.

Holotype—♂, Nordegg, Alta., Aug. 7, (J. McDunnough), No. 602, in the Canadian National Collection, Ottawa.

Paratypes—8 ♂, same locality and collector, July 27, Aug. 1, 7, in the Canadian National Collection, Ottawa.

Tortrix trentonana sp. nov.

Palpi, head, thorax and primaries light brown, latter somewhat shiny and in certain lights showing traces of scattered brown striations. Secondaries pale smoky. Expanse 21 mm.

Holotype—♂, Trenton, Ont., June 27, (J. D. Evans); No. 603, in the Canadian National Collection, Ottawa.

The species is closely allied to *alleniana* Fern. by the male genitalia; the spined side-arms of the gnathos are, however, much narrower and more pointed apically and there are differences in the shape of the transtilla and the baso-ventral portion of the claspers. Both these species agree closely with Pierce's figure of *viburniana* Fab. (Genit. Brit. Tort. 8, Pl. III) which this author places in the genus *Amelia* Hbn.

Trentonana is rather narrower winged and deeper in color than *alleniana*; this and the lack of maculation should distinguish it from its ally.

Tortrix flavidana sp. nov.

Palpi and thorax deep yellow; primaries pale yellow shaded with deeper color on inner margin; a large purple blotch in the cell, another at tornus and a small one on costa near apex of wing; slight purple shading near base of wing and a few purple striations between cellular blotch and inner margin. Secondaries whitish, shaded with smoky on inner half of wing. Expanse 26 mm.

Holotype—♀, Aweme, Man., July 6, (N. Criddle); No. 605, in the Canadian National Collection, Ottawa.

STUDIES IN CANADIAN DIPTERA

I. Revision Of The Asilid Genus Cyrtopogon And Allied Genera.

BY C. HOWARD CURRAN,
Ottawa, Ont.

(Continued from page 142)

Cyrtopogon montanus Loew.

Wholly black pilose except the head and legs, and in the ♀ the propleura. Abdominal pollinose bands of ♂ interrupted, of ♀ entire. Scutellum convex.

Length 12 to 16 mm. *Male.* Face rather strongly gibbose, more prominent above; yellowish grey pollinose; mystax yellow in the middle, the hairs fine, black laterally and below, the hairs stout, condensed above the oral margin so that they are very conspicuous; front less thickly pollinose, mostly sub-shining, the hair moderately thick, rather stout, long. Occiput whitish or pallidly yellowish grey pollinose, shining above, the hair black, long, beard white, the orbits black haired. Antennae black, thinly pale yellowish pollinose, with fine white hair; first joint twice as long as wide, second wider than long, about three-fifths as long as first; third over one-third longer than the first two combined, wholly more slender than the first, the basal half narrower; style nearly half as wide as third joint, widest at or beyond the middle, its apex not acute, the bristle very short; style not quite as long as first joint.

Thorax shining black, often chiefly shining behind, but in well preserved specimens with rather bright greyish yellow pollen, forming moderately complete 5, a slender middle vitta on the anterior half, the posterior margin broadly on the middle half, emitting a narrow stripe forward to the inner loop of the 5, and a small oblique spot inside the postalar calli; elsewhere the pollen is thinner and brownish, leaving the usual darker areas in many lights; pleura wholly thinly greyish or brownish yellow pollinose, but subshining or shining in most lights. Pile wholly black, moderately long and rather abundant, the bristles black; hairs on propleura with white apices. Scutellum convex, shining black, the disc basally yellowish pollinose. Hairs long, abundant, black, strong, no bristles.

Legs wholly black, the hind tibiae on the apical half and their tarsi basally usually piceous or piceous reddish. Pile of legs rather long and abundant, black, except as follows: all the femora below on the basal half, the posterior ones narrowly so on sub-apical half above, and the hind tibiae on the whole outer surface, best seen from basal view. Tarsi simple. Coxae chiefly white pilose, the front four on basal half of outer posterior half and the hind ones behind and in front with black pile.

Wings cinereous or yellowish cinereous, the furcation of the third longitudinal vein well beyond the apical crossvein.

Abdomen blue black, the posterior margins greyish pollinose, slightly wider laterally, broadly interrupted in the middle, wholly black pilose except a few hairs on the grey spots on the fourth and fifth segments, the discal pile short, that on the sides long and abundant; venter black pilose except the apex of the fifth segment.

Female. Mystax not quite so dense, the black hairs much less dense below.

Thorax with shorter more sparse hairs; sternopleura below and propleura white pilose; postalar calli shining black.

Tibiae all paler than in the male, sometimes reddish, or with blackish bases and elsewhere piceous reddish, or they may be only piceous with the bases darker, the hind ones paler; tarsi colored like the tibiae basally, blackish apically, but all the articulations reddish.

Second to fifth segments with greyish pollinose apices, the first two bands usually entire, sometimes narrowly interrupted, or all the bands may be entire, but the last two usually distinctly interrupted. Pile on disc short, black; on sides longer, black on bases of segments, white apically, but sometimes practically all black beyond the second segment, and always on the last three segments, where the pile is decidedly thinner and shorter.

Eleven specimens from British Columbia and Banff, Alberta, from May to June.

For two ♀ specimens, from Banff, Alta., 1911, (N. B. Sanson) and June 9, 1916, (C. G. Hewitt) with wholly white pilose lateral margins; I propose the name *latericaudus* new variety; type No. 585 in the Canadian National Collection, Ottawa.

Specimens of this species were compared with the types in the Museum of Comparative Zoology at Cambridge.

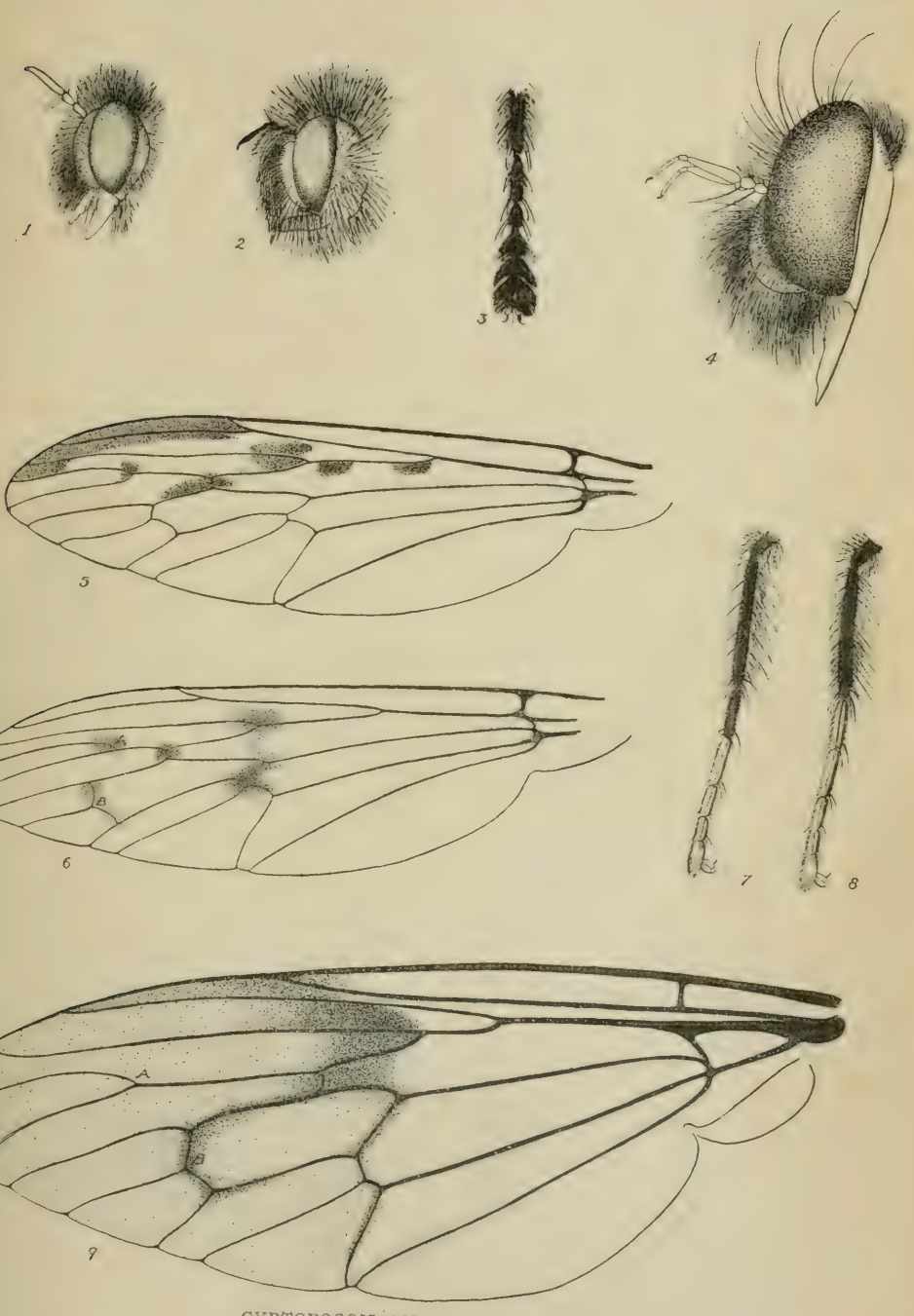
Cyrtopogon leucozona Loew.

Abdomen with complete greyish pollinose crossbands; trichostical pile white; abdominal pile whitish laterally except on bases of first, fifth and sixth segments; hind tibiae silvery white haired exteriorly.

Length, 10 to 15 mm. *Female.* Face moderately gibbose, most prominent on upper portion, yellow or greyish yellow pollinose; mystax yellow or whitish yellow in the middle, laterally and below with stouter black hairs, which are abundant just above the oral opening. Front lightly pollinose, wholly black pilose, the hair moderately long and fairly abundant. Occiput greyish pollinose, more shining above, black pilose, the beard whitish, the orbits wholly black haired. Antennae black, white haired; first joint one and one-half times as long as wide, rather stout, second as wide as long; third slightly more than one and one-half times as long as first two combined, rather slender, not as wide as first joint, narrowed on sub-basal half; style rather slender with parallel sides, as long as first joint, its spine short.

The thorax is not perfectly preserved, but appears to be marked as in *C. inversus*, only the pollen is more yellow. Pleura yellowish grey pollinose. Pile black, moderately long, but not very abundant, the posterior margin with white hairs, bristles rather fine, black; sternopleura and propleura with fine white pile, the trichostical pile yellow. Scutellum convex, shining black, the base yellowish pubescent; pile long, rather stout, black; no distinct bristles.

Legs black, hind tibiae and basal joints of their tarsi sometimes piceous reddish; femora wholly rather abundantly long, fine, white pilose, the hind ones



CYRTOPOGON AND ALLIED GENERA.

(1). *Cyrtopogon curtistylus* Curr., head; (2). *C. willistoni* Curr., head; (3). *C. willistoni* Curr., mid-tarsus; (4) and (5). *Eucyrtopogon variipennis* Coq., head and wing; (6). *E. comantis* Curr., wing, *a*, branching of 3rd vein, *b*. discal crossvein; (7). *Cyrtopogon willistoni* Curr., mid-tarsus; (8). *C. praepes* Willist., mid-tarsus; (9). *C. curtistylus* Curr., wing.

beneath with stouter black hairs on apical third. Front four tibiae and all the tarsi black haired; hind tibiae beneath with long black hair, externally with silvery white hair, some of which are rather long.

Wings cinereous hyaline; the third longitudinal vein branches well beyond the discal crossvein; crossveins somewhat brownish. Halteres yellow, the stems fuscous.

Abdomen shining blue black, the second to fifth segments with a posterior grey pollinose band, narrower in the middle, usually entire or only obscurely interrupted, the last band usually interrupted. Pile short, black, on the sides longer, white, black on bases of fourth to seventh segments, or wholly white.

Described from ♀, Vasseau Lake, B. C., May 25, 1920, (W. B. Anderson), compared with type, and ♀, Aspen Grove, B. C., June 28, 1922, (P. N. Vroom).

The ♂ is not known and must be very similar to *C. inversus* but the trichostical pile is probably chiefly or all white; the females are very similar but the trichostical pile in *inversus* is about half or more black, the sides of the segments are all partly black pilose, and the hind tibiae bear much more conspicuous white hair.

Cyrtopogon inversus new species

Readily recognized by the silvery white pilose hind femora, tibiae and tarsi.

Length 10 to 16 mm. *Male.* Face gibbose, more prominent above, whitish yellow pollinose; mystax white, soft; stout, black along the mouth edge and a row of lateral hairs. Front shining black just on the middle line, elsewhere thinly yellowish pollinose; somewhat sunken; pile black. Occiput white pollinose; sub-shining; black-haired; on the lower half except against the eyes, fine white pilose. Antennae black, first joint short, half longer than second; second almost as broad as long, bead-like; third nearly twice as long as the first two, rather slender, not more than half as wide as the first; style about as long as the first joint, slender, acute. Hair on antennae black.

Thorax shining black, the pleura yellow pollinose. Mesonotum thinly brownish pollinose in some lights; on either side of the median line before the suture is a large yellowish white pollinose spot, its inner posterior edge concave, curving to meet the suture well in from the side margin; a small pollinose spot of the same color at the inner end of the suture. Pile black, moderately long, not coarse; only the pronotum white haired. Scutellum shining black, convex, black pilose, the hairs rather stout.

Legs shining black; front four femora thinly white pilose below; thickly long black pilose above and behind; hind femora long silvery white pilose above; black pilose in front and behind; yellowish white pilose below. Front four tibiae black haired and with black bristles; hind ones thickly black pilose on inner side; on the outer with silvery white pile, which does not form a crest; hind tarsi with silvery white pile above, not crested.

Wings cinereous hyaline; stigma black. Halteres black, the knob yellow.

Abdomen shining black, the second to fifth segments with the posterior margins grey pollinose; the band on the fifth broadly interrupted, the others slightly narrowed in the middle. Pile black; long laterally; just a few white hairs on the sides of the first segment.

Female. Front grey pollinose. The whitish grey pollen forms complete "5's" on the mesonotum, and there is a faint whitish stripe on the median line in front; the whole border, a transverse spot before the scutellum which projects forward in the middle and the disc of the scutellum are whitish grey.

Middle femora with less white pile below; hind femora and tibiae with the silvery pile a little less evident, their tarsi wholly lacking it.

Abdomen with shorter pile, the first grey band often narrowly interrupted; sixth and seventh segments entirely shining black.

Holotype, ♂ Aspen Grove, B. C., June 15, 1922, (P. N. Vroom); No 572, in the Canadian National Collection, Ottawa.

Allotype, ♀ same locality and collector, June 28, 1922.

Paratypes, ♂, Darcy, B. C., May 14, 1918, (W. B. Anderson); ♀, Chilcotin, B. C., June 7, 1920, (E. R. Buckell), ♀, Nicola, B. C., June 6, 1922, (P. N. Vroom); ♀, Hadley, B. C., May 15, 1920, (W. B. Anderson).

Cyrtopogon falto Walker

Legs plain; basal third of the tibia reddish yellow, the remainder black; mystax yellow.

Length, 12 to 17 mm. *Male.* Face strongly gibbose, more prominent on the upper half; thickly clothed with yellow or greyish yellow pollen; mystax composed of long, moderately fine, yellow hairs, along the oral margin and a lateral row on the lower half, with more bristly black hairs. Front shining in the middle and against the ocellar tubercle; with similar pollen to that on the face; pile black. Occiput grey pollinose, shining above; black haired above, fine white haired below, even against the eyes on the cheeks. Antennae black, with thin brownish yellow pollen; hairs black; first joint three times as long as wide, its apex a little larger, second one and one-half times longer than wide, sub-triangular in outline, half as long as first joint; third nearly one-fourth longer than the basal two combined, just beyond the middle a little wider than the second joint; style almost as long as second joint, acute, not robust.

Thorax with the lateral margins, an elongate, oval, in front of the scutellum on either side and a rectangular spot beneath the wings, shining black; mesonotum covered with brownish golden pollen; a broad geminate median stripe and a lateral spot commencing well before the suture, darker, brownish. Pleura with the pollen greyish yellow or greyish. Pile black, rather long, not abundant; bristles evident; propleural and trichostical pile white. Scutellum tawny pubescent basally, convex, shining black; stout black haired.

Legs black; basal third of the tibiae, basal half or more of the first three tarsal joints and less than half of the last two joints, reddish yellow. Pile of front and middle femora almost all rather long, black, above, a few pale hairs towards the base; below with rather conspicuous yellow or whitish yellow pile; tibiae black haired; the middle ones with some short brassy yellow hairs behind, but these not conspicuous; front and hind tibiae with brassy yellow pubescence; tarsal pads yellow. Bristles of legs black.

Wings hyaline, sometimes a little greyish apically. Halteres yellow.

Abdomen shining black; second to sixth segments each with a small subtriangular greyish spot in the posterior angles. Pile yellow, paler and longer basally; on disc of fifth and following segments and on the genitalia, black.

Female. Mystax thinner; with more black hairs along the sides and above. Tarsal joints with only the broad bases reddish yellow. Sixth abdominal segment without grey pollinose spot.

Thirty-five specimens from Quebec, Ontario and Manitoba.

Readily recognized by the strongly bicolored tibiae.

(to be continued)

OBSERVATIONS ON THE OVIPOSITION OF SENOTAINIA TRILINEATA V. DER WULP*

BY C. HOWARD CURRAN,
Ottawa, Ont.

A specimen of *Senotainia trilineata* Van der Wulp, and a female specimen of *Ammophila communis* Cresson, have been received from Mr. W. R. Buckell, of Salmon Arm, B. C., together with observations on the manner of oviposition of the former. There is some doubt about the identity of the wasp in question, as the specimen observed provisioning the burrow was not captured and a specimen, "evidently the same species," was sent for determination. My own observations on this interesting method of oviposition were made near Lawrence, Kansas, in 1922, and while the actions of the principals concerned were practically identical, the wasp was *Sphex conditor* Smith. *Senotainia trilineata* is recorded by Aldrich as reared from *Sphex speciosus* Drury. I cannot find any reference to the manner of oviposition.

Mr. Buckell's attention was first attracted by the wasp dragging a cutworm along the roadside and its burrow was discovered about two feet away. The greater part of an hour was spent by the wasp in dragging the cutworm to the burrow. The larva was left at the surface while the burrow was entered, and the grub then dragged in after the wasp. While this was taking place four or five small flies were observed in the vicinity of the opening. The wasp drove these away before commencing to scratch in and pack the earth at the mouth of the tunnel, but while engaged in this operation one of the flies darted to the edge of the hole, turned its back and dropped an egg, which was scratched down along with the loose earth. The egg was not discovered, as the soil was full of white particles.

The process described by Mr. Buckell is almost identical with observations made by P. A. Readio and myself at Lawrence. In our case, however, only a single fly was present and this hovered in the air just above the scratching wasp and dropped an egg, which we were able to observe quite clearly as it fell, but could not discover later. While the fly in question was captured, it was not determined, but apparently was the same species. Specimens of *S. trilineata* from Manitoba, Alberta, Fort Simpson, N.W.T., British Columbia and Ontario, are before me.

We were not successful in rearing the wasp nor the fly, although all the loose soil was placed about the cutworm larva. Whether the fly is parasitic upon the wasp or merely feeds upon the caterpillar is yet to be learned.

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

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TRAP-LANTERN RECORD AT ITHACA, NEW YORK (LEPIDOPTERA)

BY W. T. M. FORBES,
Cornell University, Ithaca, N. Y.

(Continued from page 158.)

3507 *Zanclognatha*, group *jacchusalis*. 420; one brood, with climax in July. (Chart 5, 1922.)

3519 *Chytolita morbidalis* Guenee. 148; one brood in June. This species and the June-flying Z. *pedipilalis* did better than most of the deltoids in 1919. (Chart 5, 1919 and 1922.)

3523 *Renia factiosalis* Walker. 28; one brood with climax in early August. (Chart 5, 1922.)

3553 *Palthis angulalis* Hubner. 44; one principal flight in latter part of July and August, and apparently an early brood in June. The complete break in captures from August 8 to 17 is curious, but doubtless accidental. (Chart 5, 1922.)

3554 *Palthis asopialis* Guenee. 16; principal brood in August. A single specimen in June suggests an early brood. (Chart 5, 1922.)

3561 *Bomolocha baltimoralis* Guenee. 17; one brood in August. (Chart 5, 1922.)

3565 *Bomolocha deceptalis* Walker. 22; flight highly irregular with a suggestion of two broods, in June and August. (Chart 5, 1922.)

3578 *Plathypena scabra* Fabricius. 1919: 45; principal brood in October and November (a September flight may have been missed); stragglers in midsummer. 1922: 35; heavy flight in August, followed by a lighter one in the fall. The species was flying actively when the trap was discontinued, but was less common than usual; the August flight may have been of specimens that normally would wait till fall. (Chart 5, 1919 and 1922.)

3595 *Datana ministra* Drury. 87; (Chart 5, 1919 and 1922.)

3596 *Datana angusi* Grote and Robinson. 40; (Chart 5, 1919 and 1922.)

3604 *Datana integerrima* Grote and Robinson. 107; (Chart 5, 1919 and 1922.)

3607 *Datana contracta* Walker. 107; (Chart 5, 1919 and 1922.)

Each of the common Datanas showed the same curves both in 1919 and 1922; in 1919 the principal flight was in June with at most a few stragglers in July, while in 1922 each had a well marked flight in June, but a much heavier one in July, after a distinct break. There was hardly time for a second brood to feed up, so the most plausible theory is that the July emergences were of pupae that under normal conditions would have gone over several years. In any case the curves are significant. *D. integerrima* and *contracta* were not counted separately; in fact I am not very confident of determining even fresh material. A few *drexelii* may also have been counted with *ministra*. Like the others its principal 1922 flight was in July; but it failed in 1919.

3620 *Nadata gibbosa* Abbot and Smith. 17. This species seems to be behaving exactly like the Datanas. (Chart 6, 1922.)

3621 *Nerice bidentata* Walker. 1919: 10; one brood in June and a straggler in August. 1922: 7; a well marked second brood in August. (Chart 6, 1919.)

3622 *Symmerista albifrons* Abbot and Smith. 236; one brood with climax June 16. This species was extraordinarily abundant in 1919 and then had disappeared completely in 1922. A daily chart is added and will give a good idea of the flight curves of the more abundant species before smoothing. Both the tendency to appear in cycles (climaxes on June 7, 12, 16, 25, 30) and the occasional enormous flights (as on June 20) when the weather is exactly right, are characteristic of the records as a whole. (Chart 6, 1919.)

3643 *Heterocampa guttivitta* Walker. 42; one brood, with climax in early June, a little earlier in 1922 than 1919. (Chart 6, 1919 and 1922.)

3705 *Hemerocampa leucostigma* Abbot and Smith. 49; one brood with climax in August. (Chart 6, 1919 and 1922.)

3756 *Eudeilinea herminiata* Guenee. 39; three flights, with climax in June, late July, and August. Presumably the last two represent only a single brood. (Chart 6, 1919 and 1922.)

3757 *Oreta rosea* Walker (and *irrorata* Packard). 24; two broods, June and early August. Specimens of *irrorata* were taken at the dates marked *i*. (Chart 6, 1922.)

3775 *Racheospila rubrolinearia* Packard. 5; two broods, May and July. (No chart.)

3783 *Nemoria mimosaria* Guenee. 22; one brood in June, and apparently a partial second in July. (Chart 6, 1919.)

3800 *Synchlora aerata* Fabricius. 26; two broods; June and August. (Chart 6, 1922.)

3818 *Chlorochlamys chloroleucaria* Guenee. 134; two broods, with climax in early June and near beginning of August. (Chart 6, 1919 and 1922.)

3857 *Acidalia enucleata* Guenee. 155; one brood in July, with a few stragglers. Far more abundant in 1922 than 1919, as in other midsummer species (140 to 15) (Chart 6, 1919 and 1922).

3901 *Acidalia inductata* Guenee. 26; apparently two broods, early June and August. (Chart 6, 1919 and 1922.)

3912 *Haematopis grataria* Fabricius. 1919: 14; one well marked brood in August and early September, and two specimens in early June, indicating another brood. 1922: 26; principal flights in July and middle of August, with no specimens in June, but a straggler in May, and the August flight lasting heavily into September. There is no resemblance between the curves for the two years, and the species must be exceptionally sensitive to the weather. (Chart 6, 1919 and 1922.)

3914 *Pleuroprucha insulsaria* Guenee. 50; three flights with climax July 8, August 14, and in October. (Chart 7, 1919 and 1922.)

3962 *Dyspteris abortivaria* Herrich-Schaffer. 21; two broods with climax about June 12 and August 8. (Chart 7, 1922.)

3977 *Lygris diversilineata* Hubner. 123; one brood with climax near end of July. (Chart 7, 1919 and 1922.)

4037 *Xanthorhoe lacustrata* Guenee. 1919: 11; one brood in June and stragglers in August. 1922: 22; two broods, May and August. Another

species that shows an extra August brood in 1922. (Chart 7, 1922.)

4054 *Orthonama obstipata* Fabricius (*Percnoptilota fluviata*). 61; principal flight in August; another brood in October, reappearing in May. (Chart 7, 1922.)

4072 *Euphyia intermediata* Guenee. (*Mesoleuca lacustrata*). 15; two broods in June and August (Chart 7, 1922).

4074 *Euphyia centrostrigaria* Wollaston. (*Hydriomena latirupta*). 23; flight irregular. The conditions are probably the same as in the closely related *O. obstipata.* (Chart 7, 1922.)

4122 *Eudule mendica* Walker. 13; one brood in the early part of July (Chart 7, 1922.)

4280 *Horisme intestinata* Guenee. 19; two broods, in May and June, and August. (Chart 7, 1922.)

4293 *Bapta vestaliata* Guenee. 18; one brood in early June, and some stragglers. (Chart 7, 1919.)

4303 *Physostegania pustularia* Guenee. 1919: 75; one very large flight on June 27 and a second straggling flight centering about August 2. 1922: 158; first flight heavy, and lasting well through July, second indicated by a few specimens in August. The graphs would suggest a single principal brood, very sensitive to weather conditions, and a small second brood. (Chart 7, 1919 and 1922.)

4338 *Macaria minorata* Packard. 23; three flights in June, late July, and August. Not taken in 1919. The Macaria group appeared very irregularly. There would appear to be two broods, but flight dates indicate nothing really clearly. (Chart 7, 1922.)

4339 *Macaria bisignata* Guenee. 1919: 7; one flight, reaching its climax at the beginning of July. 1922: 14; flight irregular, lasting well through August (Chart 7, 1922).

4345 *Macaria granitata* Guenee. 1919: 20; one well marked flight with climax June 20, and a second straggling one in August. 1922: 20; two broods centering about July 1 and August 19, and two specimens in the middle of May, possibly indicating another generation. (Chart 7, 1919 and 1922.)

4465 *Caripeta divisata* Walker. 58; one brood in July. In 1922 ten specimens of a striking aberration were taken, plotted on the graph by the letters A. (Chart 7, 1922.)

4486 *Nepytia canosaria* Walker. 67; one brood in September. The principal flight of this species falls in the period when the trap was not running in 1919. (Chart 7, 1922.)

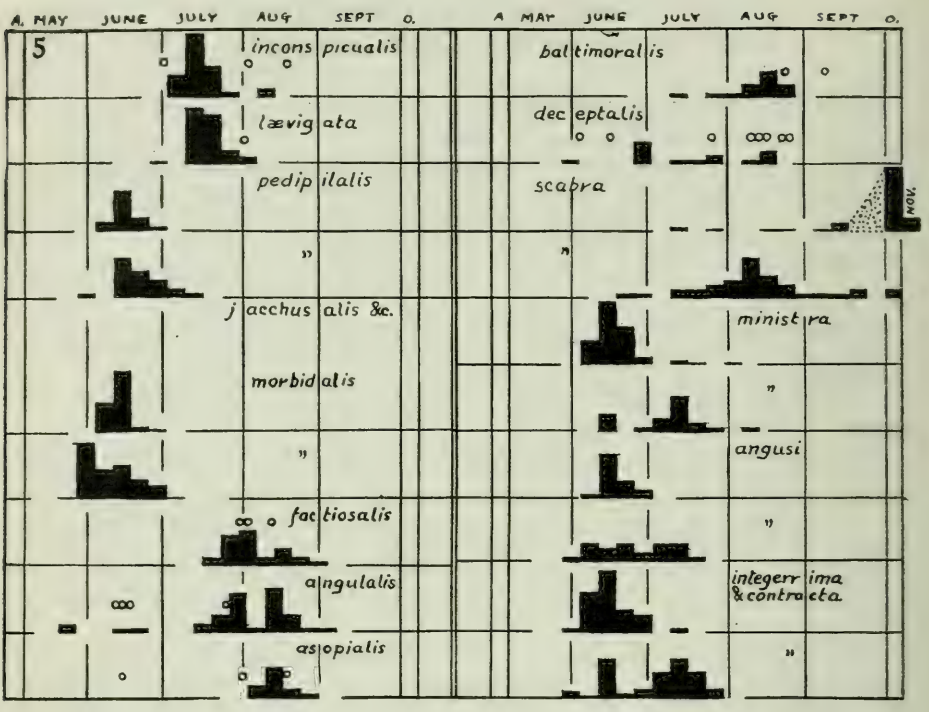
4570 *Cleora pampinaria* Guenee. 11; principal brood in August, another early brood indicated by stragglers. (Chart 8, 1922.)

4584 *Cleora ephyraria* Walker. 50; one brood in July. (Chart 8, 1922.)

4599 *Melanolophia canadaria* Guenee. Apparently one brood in the spring, with an odd specimen appearing in 1919 on August 29. More than one species may be represented in the series. (Chart 8, 1919 and 1922.)

4654 *Ellopia (Therina) fiscellaria* Guenee. 30; one brood in September and October, largely missed in 1919. (Chart 8, 1922.)

4659 *Campaea perlata* Guenee. 29; two broods in June and August.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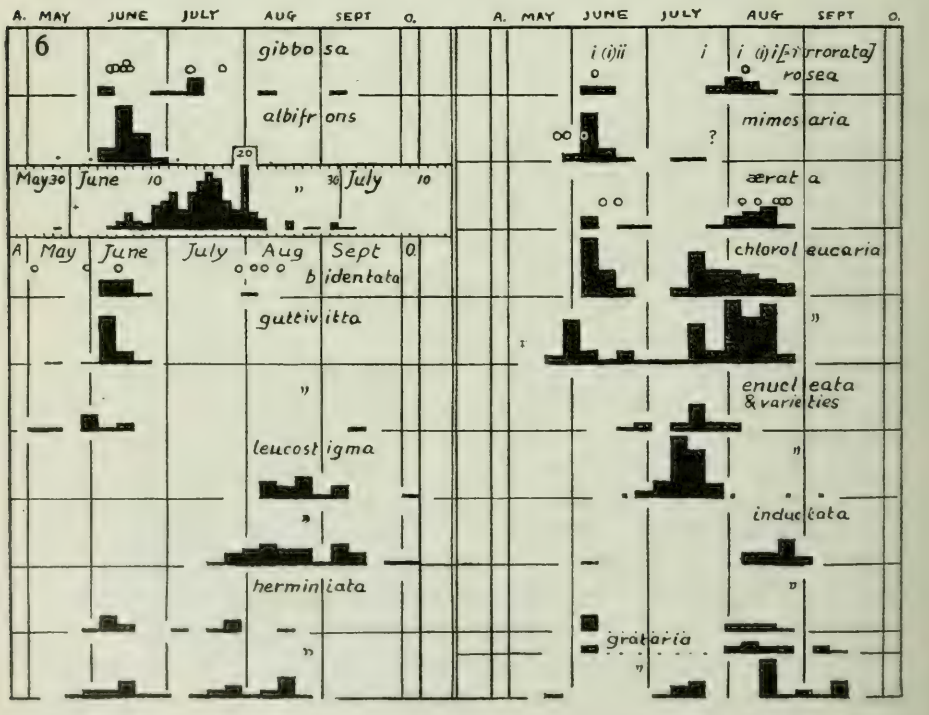
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(Chart 8, 1922.) Only a single specimen was taken in 1919, belonging to the first brood.

4661 *Eugonobapta nivosaria* Guenee. 48; one brood before the middle of July and a few stragglers. (Chart 8, 1919 and 1922.)

4664 *Ennomos subsignarius* Hubner. 90; one flight in July. The few specimens taken in 1919 flew later than in 1922. (Chart 8, 1919 and 1922.)

4666 *Xanthotype crocataria* Fabricius. Two broods, in June and August. As frequently, the second brood was relatively much heavier in 1922. (Chart 8, 1919 and 1922.)

4678 *Hyperetis amicaria* Herrich-Schaffer. 33; one brood in June. (Chart 8, 1919.)

4680 *Nematocampa limbata* Auct. (*filamentaria*). 200; one strong brood in late June and the first half of July, and a few stragglers in August. Exceptionally the weak second brood is no more developed in 1922 than in 1919. (Chart 8, 1919 and 1922.)

4685 *Gonodontis hypochraria* Herrich-Schaffer. 58; one brood in early part of June; a little later in 1919. (Chart 8, 1919 and 1922.)

4744 *Pero honestarius* Walker. 35; one brood with climax at end of May, and a weak second in August (four specimens in the two years together) (Chart 8, 1922).

4752 *Pero marmoratus* Grossbeck. 22; presumably two broods, one in June, and the other centering about August 1. Only the early brood was well marked in 1919, and only the late one appeared in 1922. The life history is obviously different from *P. honestarius*. (Chart 8, 1922).

4762 *Tetracis crocallata* Guenee. 81; one brood in June. (Chart 8, 1922.)

4769 *Sabulodes lorata* Grote. One strong brood in June, and stragglers in midsummer. I suspect the 21 specimens recorded for July 16 have been mislabelled in some way. The four taken in September, 1922, are correct. (Chart 9, 1919, 1922.)

4777 *Sabulodes transversata* Drury. 447; one heavy brood in midsummer. In 1922 this was by far the commonest of geometers, and by a little the most abundant moth at the trap, 395 specimens being taken and counted. (Charts 9, 1919 and 1922.)

4780 *Abbotana clemataria* Abbot and Smith. 68; one brood in May, lasting over into the first part of June. (Chart 9, 1919 and 1922.)

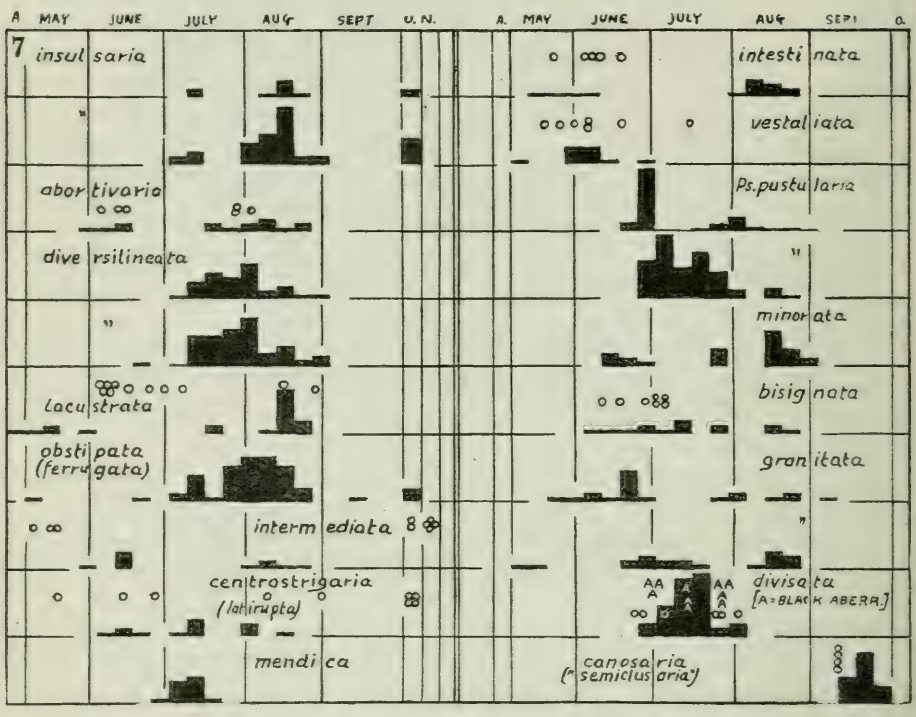
4842 *Lithacodes fasciola* Herrich-Schaffer. 29; one brood in July. (Chart 9, 1922.)

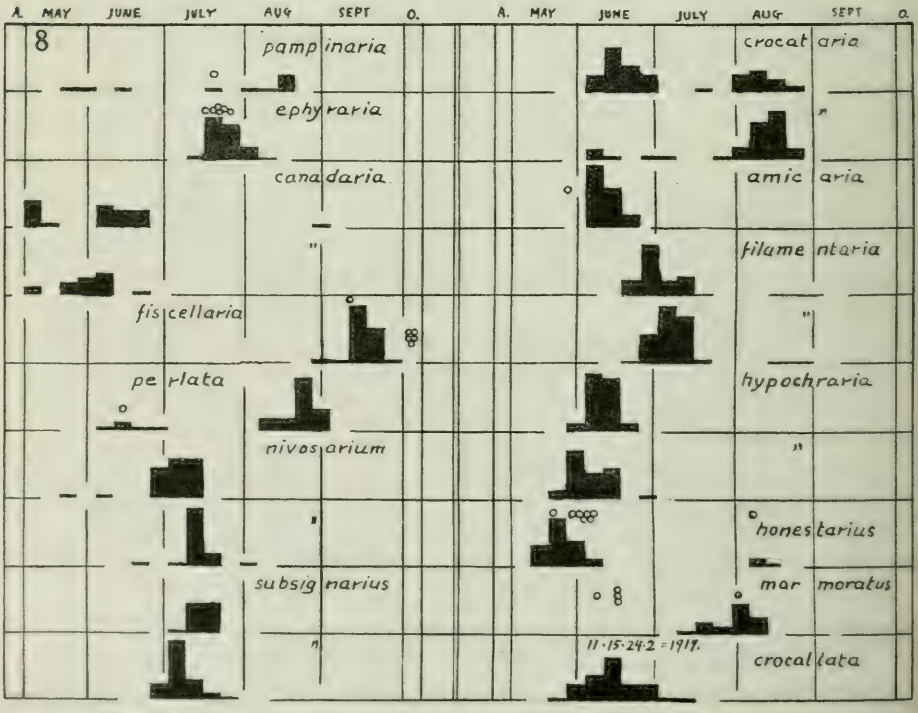
4843 *Packardia elegans* Packard. 1919: 7; one brood in June, apparently cut off short by the dry season. 1922: 17; one brood centering July 2. The moist season of 1922 was favorable for Eucleidae, 7 species being taken, and 51 specimens, as against 12 in 1919. (Chart 9, 1922.)

In the following Microlepidoptera charts are only given of the most abundant species, though data are presented here on several others.

4921 *Desmia funeralis* Hubner. 21; flight irregular from June 7 to August 13, with climax about July 15. (No chart.)

4960 *Pantographa limata* Grote and Robinson. 24; June 18 to August 4, with climax about July 14. (Chart 9, 1922.)





TRAP-LANTERN RECORDS.

5004 *Evergestis straminalis* Hubner. 206; two broods, with climax about June 12 and August 20. (Chart 9, two years combined.)

5005 *Crocidophera serratissimalis* Zeller. 12; June 17 to July 25, a little earlier in 1919. (No chart.)

5020 *Loxostege marculenta* Grote and Robinson. 42; one principal brood, with climax about June 29, and stragglers from May 17 to August 19, the last perhaps an attempt at a second brood. (Chart 9, 1919.)

—— *Bocotarcha demantrialis* Dru. 5; July 24 to August 14.

5088 *Phlyctaenia ferrugalis* Hubner. 56; a heavy brood in October and November, and a scattering summer brood, flying mostly in July and the first of August. The secondary maximum in the end of August appeared both years, and may represent another partial (second) brood. (Chart 9, combined.)

5099 *Phlyctaenia terrealis* Treitschke. 128; two broods, June and August. (Chart 9, combined.)

5102 *Phlyctaenia tertialis* Guenee. 96; first brood in latter half of June, continuing in smaller numbers well through July; second brood in August. (Chart 9, combined.)

5111 *Pyrausta pertextalis* Lederer. 90; two broods, in June and August (Chart 9, combined). In the case of *pertextalis* and *fissalis* a considerable number of specimens have been omitted as doubtful, but still the difference in flight period of the two species is well-marked.

5112 *Pyrausta fissalis* Grote. 160; one brood, with climax rather before the middle of July. The peak at the end of June, 1919 is almost entirely caused by 24 specimens taken June 27. (Chart 9, 1919 and 1922.)

5113 *Pyrausta aeglealis* Walker. 74; one brood in July, perhaps a few days later than *P. fissalis* on the average. The single supposed specimen taken in May may be different, it is very small. (Chart 9, 1922).

5239 *Scoparia cinereomedia* Dyar. 15; one brood with climax before middle of July.

5273 *Galasa nigrinodis* Zeller. 41; one brood, at end of June in 1919, with climax about July 10 in 1922, when the species was exceptionally common This species is another that has seemed to take advantage of the moist July of 1922 to multiply far beyond the normal for Ithaca. (Chart 9, 1922.)

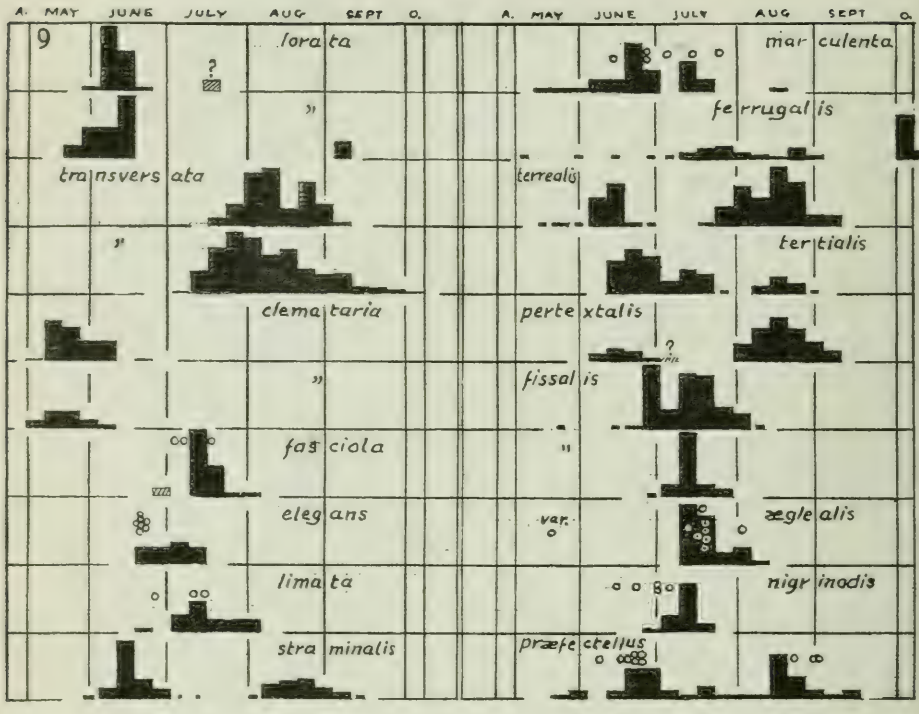
5338 *Crambus pascuellus* Linnaeus (*floridus*). 8; one brood, June 12 to 29. The Crambus records are given more fully than in the other genera, on account of the general interest, and for comparison with those published long ago in Felt's monograph.

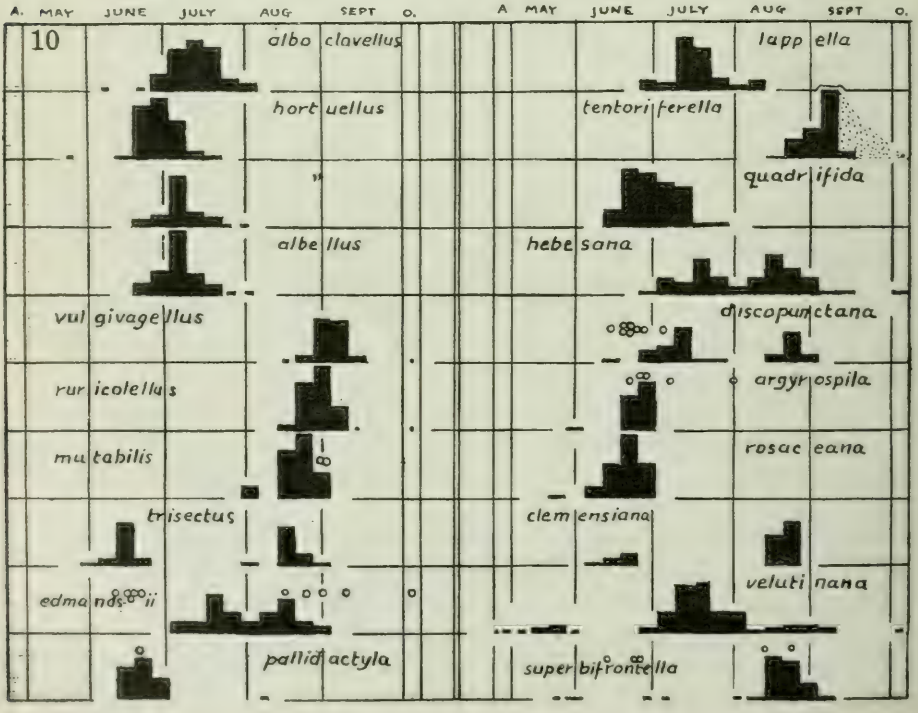
5341 *Crambus girardellus* Clemens. 12; one flight, June 19 to July 22.

5344 *Crambus praefectellus* Zincken. 58; two broods, with climax about June 20 and August 15. As usual the second brood was proportionately weak in 1919. (Chart 9, 1922.)

5353 *Crambus alboclavellus* Zeller. 82; one brood with climax about July 10. (Chart 10, combined.) I am not very confident of my separation of *alboclavellus* and *agitatellus*, as some of the material is a good deal rubbed. Both species, though, obviously have identical curves.

5355 *Crambus agitatellus* Clemens. 34; this species also plainly shows one brood with climax about July 10, but the certainly determinable specimens appear to scatter along rather more.





TRAP-LANTERN RECORDS.

5358 *Crambus laqueatellus* Clemens. 12; one brood, with climax about June 13.

5361 *Crambus hortuellus* Hubner. 182; the difference of curve in the two seasons is striking. (Chart 10, 1919 and 1922.) Climax in 1919 about June 25, in 1922 about July 5.

5362 *Crambus albellus* Clemens. 63; here again the 1919 flight centers about June 27, the 1922 flight, which was heavier, about July 6. (Chart 10, 1922 only.)

5366 *Crambus elegans* Clemens. 12; one brood, centering at the end of July.

5367 *Crambus polingi* Kearfott. 4; July 12 to 16. First record for the eastern states. These two species were taken only in 1922.

5368 *Crambus vulgivagellus* Clemens. 192; one brood, with climax at beginning of September. (Chart 10, combined.)

5371 *Crambus ruricolellus* Zeller. 347; one brood with climax at end of August. (Chart 10, combined.)

5384 *Crambus mutabilis* Clemens. 38; one brood in latter half of August. Common in 1922, scarce in 1919. (Chart 10, 1922.)

5392 *Crambus trisectus* Walker. 32; two broods, in June and August. This species also was scarce in 1919. (Chart 10, 1922.)

5367-5399 *Crambus* group *luteolellus,* 125; two broods, June 16 to September 1. I am entirely unable to separate these three supposed species, which intergrade completely superficially (*luteolellus* is supposed to have distinct genitalia). Typical specimens of each taken alone give the same seasonal curves.

5490 *Tetralopha asperatella* Clemens. 26; one brood from June 8 to 27, in 1919; one brood from July 1 to 23 in 1922, with stragglers May 31 and June 13. This is another species that proved exceptionally sensitive to the weather conditions.

5726 *Vitula edmandsii* Packard. 1919: 10; two broods, the principal in June, the second August 15 to September 5, with a straggler October 9. 1922: 42; one flight, with two maxima about July 18 and August 15. (Chart 10, 1922.)

5835 *Peoria approximella* Walker. 18; one brood, June 15 to July 15.

5881 *Platyptilia pallidactyla* Haworth. 46, all but one taken in 1919; one principal brood in latter part of June, and a straggler August 8. (Chart 10, 1919.)

6021 *Metzneria lapella* Linnaeus. 66; one brood in July. (Chart 10, combined.)

6041 *Aristotelia roseosuffusella* Clemens. 22; irregular, June 25 to August 23.

6424 *Cryptolechia tentoriferella* Clemens. 134; one brood with climax in early September. The chart is mainly based on 1919, and the area when the trap was not running is indicated by a dotted area. (Chart 10, combined.)

6798 *Exartema permundanum* Clemens. 14; one brood, July 3 to 28.

6800 *Exartema concinnanum* Clemens. 11; one brood, June 28—July 27.

6807 *Exartema inornatanum* Clemens. 14; July 8 to August 23.

6807.2 *Exartema quadrifidum* Zeller. 50; one brood with climax at end of June. (Chart 10, combined.)

6810 *Exartema merrickanum* Kearfott. 21; one brood; June 20 to July 16.

6827 *Argyroploce hebesana* Walker. 48; two flights, with maxima about July 18 and August 15. The two maxima were plainly shown both years. (Chart 10, combined.)

7281 *Coelostathma discopunctanum* Clemens. 1919: 8; one brood in the latter part of June. 1922: 28; two broods, in early July and late August. (This species again shows the extra brood in 1922.) (Chart 19, 1922.)

7316 *Sparganothis sulfurcana* Clemens. 28; two broods, the first in June in 1919, represented by two specimens in early July in 1922; the second in the latter half of August, running over into September in 1919.

7345 *Cacoecia obsoletana* Walker. 29; apparently one brood, flying mostly in July in 1919, in August in 1922.

7353 *Cacoecia argyrospila* Walker. 25; one brood at end of June, and a few stragglers. (Chart 10, 1922.)

7356 *Cacoecia fractivittana* Clemens. 9; one brood, with climax June 12.

7361 *Cacoecia rosaceana* Harris. 35; one brood in June. (Chart 10, combined.)

7364 *Tortrix quercifoliana* Fitch. 15; one flight with climax July 3, and a straggler August 2.

7367 *Tortrix clemensiana* Fernald. 31; two broods in June and August. (Chart 10, 1922.)

7390 *Eulia velutinana* Walker. 103; one heavy brood in July, smaller ones in May and beyond middle of August, and a straggler October 22, 1919. The three main broods are shown both years in about the same proportions. (Chart 10, combined.)

7556 *Carposina fernaldana* Busck. 22; one flight; July 21 to August 23.

8054 *Gracilaria superbifrontella* Clemens. 60; one principal brood in August and stragglers. The trap was not running at the season to catch the winter brood, save for a few May survivals. (Chart 10, 1922.)

8234 *Xylesthia pruniramiella* Clemens. 17; one principal flight from June 30 to July 25, and single specimens August 14 and 23.

ZARRHIPIS — A CORRECTION

The transposition of two lines in the May number of this journal renders the description of *Zarrhipis alamedae* incomplete. Delete the first two lines on p. 110, or transfer them to the top of p. 111. The corrected description is as follows:

Z. alamedae new species

Rufotestaceous; antennae except at base, and seventh and eighth abdominal segments black. Last joint of maxillary palpi piceous, elongate triangular, twice as long as wide, the apical edge shorter than the inner. Prothorax about four-sevenths as long as wide, sides moderately margined. Elytra about four and one-half times as long as the thorax, more strongly scabrous than in any of the preceding species. Length (to elytral apex) 9.5 to 12 mm.

STUDIES IN CANADIAN DIPTERA

I. Revision Of The Asilid Genus Cyrtopogon And Allied Genera.

BY C. HOWARD CURRAN,

Ottawa, Ont.

(Continued from page 174.)

Cyrtopogon willistoni Curran

Allied to *praepes* Williston but the first joint of the front tarsus is not silvery white pilose above.

Length, 11 to 16 mm. *Male.* Face strongly gibbose, convex-receding from a little below the antennae; moderately whitish-yellow pollinose; middle of face with tawny to yellow fine pile, bordered laterally with one or two rows of strong black hairs, all the hairs just above the oral opening stout and black. Front shining black in the middle, with a longitudinal groove, the sides yellow pollinose, the pile wholly black. Occiput black; black pilose, the immediate orbits wholly with a row of black hairs, the lower half with fine whitish yellow pile. Antennae wholly black, the basal segments with long black hairs; third joint longer than the basal two combined, coarctate basally, but wholly rather slender, its greatest width about the apical fourth or fifth; style one-fourth the length of the third joint, with a short, terminal spine-like process. The length of the antennae is about equal to the length of the face.

Thorax shining black, the 5 shaped brownish-yellow pollinose marking seldom complete, as the dash and lower portion is usually missing (usually present in large specimens, but not in the type); a slender or rather narrow median line on the anterior half of the same color and the posterior portion, when viewed from in front, with similar pollen. Pollen on the pleura similar in color to that on the dorsum; the scutellum with a richer colored pollen in certain lights, but generally appearing shining black. Pile moderately abundant, rather long, black; on the pleura chiefly yellowish, but almost all black on the meso- and sternopleura. Scutellum convex.

Legs black; hind tibiae sometimes quite reddish except the broad apex and very narrow base, at other times only slightly lighter in color on the basal two-thirds. Femora with rather abundant, long pale yellow pile, but behind, more or less, and apically, especially above, with black pile. Tibiae black pilose, the hind ones and sometimes the anterior four also, with yellow hairs in front. Anterior tibiae anteriorly and the hind ones on the apical fourth interiorly, golden tawny pubescent. Anterior tarsi with a long, silvery white crest on the last four joints, the hair parted anteriorly near the base, but not usually distinctly parted on the second joint; first joint black haired, rarely with just a few whitish hairs above before the apex; the last joint of the fore tarsus is longer than either the third or fourth, their ventral cushions tawny. Middle tarsi wholly black haired, the last two joints with anterior and posterior tufts of rather long hairs, the second and third with distinctly shorter tufts anteriorly, but the second may often be without the conspicuous tuft, the third joint usually has a small tuft behind; the fifth joint is nearly as long as the first. Hind tarsi simple; black pilose.

Wings cinereous or luteous hyaline. Squamae brown or brownish, with broad yellow border and sparse whitish fringe. Halteres yellow, the stem more

or less infuscated.

Abdomen shining black, without pollinose spots or bands. Pile black; on the sides of the first two segments and the posterior angles of the two or three following, with yellow pile; this gives the appearance of tufts laterally. Sometimes the first three segments are wholly yellow pilose on the sides.

Female. Mystax rarely as in the male, usually much more blackish as the strong black hairs are scattered throughout the yellow ones; front more shining, beard paler. Thorax with the pollen yellowish on the middle of the dorsum, greyish laterally, the median stripe broader, entire, the 5 complete, usually wholly closed so that is resembles a 6; posterior portion of the thorax with greyish white pollen. Legs wholly simple; similar in colour. First to fifth abdominal segments with a roundedly triangular pollinose spot on the posterior angles, those on the fifth segment very small; the light coloured pile is usually less bright yellow.

Over one hundred specimens from British Columbia and Banff, Alta.

Cyrtopogon leptotarsus new species

Last joint of fore tarsus as long as the preceding three together, and extremely flat.

Length, 12 mm. *Male.* Face shining black; strongly gibbose, the swelling reaching to the base of the antennae and strongest above, sides densely greyish. Mystax strong, long, black, bordered on either side with fine white hair. Front opaque black, with a small shining area before the ocelli; pile as long as the first two antennal joints, black. Occiput wholly black pilose along the eyes, elsewhere with fine white pile. Antennae black, black haired; (third joint missing).

Thorax shining black; pleura whitish pollinose: (the mesonotum has been wet, and it is not possible to follow the color of the pollen, which is less abundant than usual). Hair of the dorsum all rather short and fine; humeri and postalar calli with fine white hair; pleura fine white pilose; just a few black hairs on the mesopleura and epipleura. Scutellum a little convex, with a slight dull yellowish bloom; at the base with two impressions which are not deep in the middle; clothed with not abundant, not wooly white hair, and lacking bristles.

Legs: femora black, just the tips reddish yellow; tibiae and tarsi all dirty yellowish, the apical half of the last joint of the front tarsi black. Pile of femora, long, white, fine, becoming black and stouter on apical fourth; tibiae with black hair and bristles, the hair long and moderately abundant, especially on the hind pair; tarsi with black hair and bristles, the hind ones with coarse yellow foot pads; front tarsi with fine pale hair beneath and on the under edges; above, anteriorly with a row of long black bristles on the first four joints and a row of very much shorter bristles behind, some of which are yellow basally. The front tibiae bear two remarkably long apical bristles on the front side, which reach to the apex of the second tarsal joint, and several other much shorter ones. All the bristles except those on the middle and hind tarsi are slender. Front tibiae a little curved; hind ones gradually increasing in thickness. Last joint of front tarsus equal in length to the three preceding, and remarkably flat, curved upward about the middle and slightly convex above beyond this point.

Wings glassy hyaline.

Abdomen shining black; short black pilose, the side margins with longer white pile, which is very conspicuous on the first two segments, and shorter white pile extends inwards before the sutures, but does not form entire bands. All the segments, including the first one, have complete posterior greyish pollinose band. Genitalia yellowish pilose, but some long black or brown hairs above.

Female. Length 15 mm. Mystax less dense, the pale hairs on the sides more yellow. Third antennal joint a little longer than the basal two together, rather broad, its base only a little narrowed; style stout, tapering, its apical third slender, acute.

Apparently there is a whitish pollinose stripe on either side of the broad, shining middle line. Pile on the dorsum shorter, longer on the pleura and no black hairs on the epipleura.

Legs similar but not specialized, the two long bristles are present on the front tibiae but reach only to the apex of the front basitarsus.

The pile on the whole insect is more yellow than in the ♂.

Holotype.— ♂, Norman, Ontario, July 19, 1908, (J. B. Wallis), No. 567 in the Canadian National Collection.

Allotype— ♀, Sudbury, Ont., 1890, (Evans).

Paratype— ♀, Sudbury, Ont., Aug. 18, 1889, (Evans).

Cyrtopogon lineotarsus n. sp.

Very similar to *leptotarsus* but the scutellum is more flattened and bears stouter apical hairs.

Length, 11 mm. *Male.* Face strongly gibbose, more prominent above, the swelling reaching to the base of the antennae; the side of the swelling "ridged"; grey pollinose; mystax black, its sides white. Front slightly convex, not or scarcely sunken, thinly greyish pollinose; black pilose. Occiput grey pollinose, wholly black pilose along the eyes, whitish behind. Antennae black, the first two joints with greyish bloom, first twice as long as second, second as broad as long, both black-haired; third equal to first two combined, widest beyond middle; style half as long as third joint, not slender, tapering.

Thorax shining black; evidently pollinose as in *leptotarsus,* the pleura grey pollinose, mesopleura more shining. Pile black, rather fine, not long; no bristles. Pleura whitish pilose, the mesopleura alone chiefly black haired. Scutellum flat, grey pollinose, white pilose, the hair fine, rather long, stout and with an apical fringe of stouter hairs.

Legs black, tarsi reddish or piceous; femora whitish pilose, but with black hair intermixed and all black apically; tibiae rather densely black haired; bristles fine, black; front tibiae with two long apical bristles reaching almost to the apex of second tarsal joint, otherwise with only two or three short bristles Front tarsi reddish, the fifth joint longer than the three preceding combined, blackish, slightly convex, black haired on apical half, wholly remarkably flattened. On the anterior upper margin of the first four joints of the fore tarsi a row of long black bristles. Front tibiae slightly arcuate.

Wings limpid hyaline. Halteres yellow.

Abdomen shining black, each segment grey pollinose on the posterior margin, including the first. Pile black on the dorsum and genitalia, whitish and longer on the sides.

Holotype— ♂, Banff, Alta., August 3, 1908, (N. B. Sanson), No. 570, in the Canadian National Collection, Ottawa.

Readily distinguished from *leptotarsus* by the pile on the last joint of the front tarsus, narrower black pilose facial stripe; more flattened, pollinose scutellum, apical bristly hairs, etc.

Cyrtopogon predator new species

Face black pilose in the middle, white on the sides; scutellum flat, grey pollinose; without stronger bristles apically.

Length, 18 mm. *Female*. Face strongly gibbose, most prominent above, the sides of the swelling "ridged," black pilose in the middle, the sides broadly white pilose so that it leaves a conspicuous median band; ground color obscured by greyish white pollen. Front shining black, a little depressed, black pilose. Occiput grey pollinose, shining just below the vertex; narrowly black pilose along the eyes, elsewhere, white. Antennae black, thinly grey pollinose; third joint missing; first joint twice as long as second, second as broad as long.

Thorax grey pollinose, the mesonotum shining; a slender median yellowish stripe on the anterior half of the middle line; on either side with an elongate greyish yellow spot on the middle; humeri and inside them, greyish yellow; separated from them by a black stripe is a transverse greyish yellow stripe, which curves back on reaching the sides and runs to behind the root of the wings, the postalar calli also greyish. The transverse band is broadly interrupted in the middle. Pile on dorsum black, not abundant nor strong. Humeri, postalar calli and pleura, white pilose; mesopleura entirely black pilose. Scutellum flat, grey pollinose; fine white pilose, without strong apical hairs.

Legs shining black, the knees narrowly dark reddish; hind tibiae chestnut brown. Pile on femora long, fine, white; on their apices and elsewhere on the legs black. Bristles black. Inside of front tibiae and inner apices of the hind ones, yellow pubescent. Tarsal joints black, their apices red. Bristles strong, black. Front tibiae with two long apical spines which reach almost to the apex of the basitarsi.

Wings limpid hyaline. Halteres yellow.

Abdomen shining black; first to fifth segments grey pollinose posteriorly, with no indication of interruption. Pile white, fine, not abundant; black, short, on the disc. Last two segments with narrow reddish apices.

Holotype— ♀, Fort Fraser, B. C., August 15, 1919, (W. B. Anderson), No. 571, in the Canadian National Collection.

This differs from *lineotarsus* by the wholly fine hair on the thorax, etc. From ♀ *leptotarsus* it differs in the darker legs, narrow black pilose facial stripe, absence of pollen on the sixth segment, etc.

CATALOGUE OF DESCRIBED NORTH AMERICAN SPECIES.

This catalogue lists all the described species from north of Mexico. It omits any references which merely record localities, including only such as are of value in relation to the identification of the species in question. All the species described previously to 1909 are included in Back's paper. The new species described in the present paper are omitted from the catalogue.

Comantella Curran.

cristata Coq., Can. Ent., XXV, 33, 1893, (Blacodes); Back, Trans. Am. Ent. Soc.,

XXXV 377, 1909, (Cophura).

? cyrtopogona Cole, Proc. Calif. Acad. Sci., IX, 236, 1919, (Cophura).—Ore.

maculosa Coq., Proc. Ent. Soc. Wash., VI, 184, 1904, (Cyrtopogon maculosis); Back, Trans. Am. Ent. Soc. XXXV, 283, (id.); Back, Trans. Am. Ent. Soc., XXXV, 378, (Cophura fallei)—Wash., Colo., Calif., Ore., B. C.

Eucyrtopogon Curran.

nebulo O. S., West. Dipt., 309, 1877; Willist., Trans. Am. Ent. Soc., XI, 14, 1884; Back, Trans. Am. Ent. Soc., XXXV, 294, 1909—Calif., Wash., Ore., B. C.

varipennis Coq., Proc. Ent. Soc. Washington, VI, 184, 1904; Back, Trans. Am. Ent. Soc., XXXV, 295, 1909; —Washingon, Ore., B. C.

Cyrtopogon Loew.

albitarsis Curran, Can. Ent., LIV, 278, 1923.—Alta.

alleni Back, Trans. Am. Ent. Soc., XXXV, 261, 1909.—N. H.

anomalus Cole, Proc., Calif. Acad. Sci., IX, 231, 1919.—Ore.

auratus Cole, (id. 230), 1919.—Ore.

aurifex O. S., West. Dipt., 301, 1877; Back, (l. c., 272), 1909.—Calif.

bimaculata Walk., Dipt. Saund., 102, 1851; Loew, Berl. Ent. Zeit., 365, 1874; Loew, Cent. VII, 61, 1866; (*Dasypogon melanopleuris*); (Back, l. c., 262) —N. H., N. M., Minn., Man., Alta.

callidpedilus Loew, Berlin Ent. Zeit., 358, 1874; Back, (l. c. 268), 1909.

cerussatus O. S., West. Dipt., 308, 1877; Back, (l. c., 291), 1909.—Calif.

cretaceous O. S., West. Dipt., 302, 1877; Back, (l. c., 287), 1909.—Calif.

cymbalista O. S., West. Dipt., 297, 1877; Back, (l. c., 269), 1909.—Calif.

dasyllis Willist., Kans. Univ. Quart., II, 66, 1893; Back, (l. c., 277).—Colo., B. C.

dasylloides Willist., Tr. Am. Ent. Soc., XI, II, 1884; Back, (l. c., 283), 1909—Ore.

dubius Willist., Tr. Am. Ent. Soc., XI, 13, 1884; Back, (l. c., 288), 1909.—Calif.

falto Walker, List I, 355, 1849, (*Dasypogon*); Loew, Cent. VII, 55, 1866, (*chrysopogon*); Back, (l. c., 263), 1909.—N. S., N. B., Que., Mass., N. Y., N. J., Fla., Ill., Man., Ont.

? gibber Willist., Tr. Am. Ent. Soc., XI, 14, 1884; Big. (? *Holopogon appendiculatum*), Annales, 1878, 483. (Syn. by Back.)

infuscatus Cole, Proc. Calif. Acad. Sci., IX, 233, 1919.—Ore.

leucozonus Loew, Berl. Ent. Zeit., 1874, 364; O. S. West. Dipt., 299, 1877; Back, (l. c. 282), 1909.—Calif., N. M., B. C.

longimanus Loew, Berl. Ent. Zeit., 1874, 360; O. S., West. Dipt., 303, 1877; Back, (l. c. 278), 1909.—Calif., B. C.

lutatius Walker, List II, 357, 1849; Back, (l. c. 265), 1909.—N. S., Mass., Ont., Pa., N. Y.

lyratus O. S., Cat., 232, 1878; Back, (l. c. 265).—N. H., N. Y.

marginalis Loew, Cent. VII, 60, 1866; Back, (l. c. 267).—Canada, N. H., Mass., Conn., N. Y., N. J., Va.

montanus Loew, Berl. Ent. Zeit., 362, 1874; O. S., West. Dipt., 298, 1877; Back, (l. c. 280).—Colo., N. M., B. C., Alta.

nigricolor Coq., Poc. Ent. Soc. Wash., VI, 183, 1904.—Calif.

nugator O. S., West. Dipt., 307, 1877; Back, (l. c. 289).—Calif., Ore., B. C.

perspicax Cole, Proc. Calif. Acad. Sci., IX, 233.—Ore.

plausor O. S., West. Dipt., 307, 1877; Back, (l. c. 270).—N. M., Colo., Nebr., Utah, Idaho, Mont.

positivus O. S., West. Dipt., 307, 1877; (Back, l. c. 290).—Calif., Idaho., N. M., Ariz.

praepes Willist., Trans. Am. Ent. Soc., XI, 12, 1884; (Back, l. c. 271).—Wash., Idaho, Calif., Colo. (I have seen specimens from these localities.)

princeps O. S., West Dipt., 302, 1877; Back, (l. c. 273); Cole, Proc. Calif. Acad. Sci., IX, 234, 1919.—Calif., Ore.

profusus O. S., West. Dipt., 305, 1877; Back, (l. c. 286).—Calif.

pulcher Back, Trans. Am. Ent. Soc., XXXV, 274, 1909.—Colo.

rattus O. S., West. Dipt., 308, 1877; Back, (l. c. 285).—Ariz.

rejectus O. S., West. Dipt., 307, 1877; Back, (l. c. 289).—Calif.

rufotarsus Back, Trans. Am. Ent. Soc., XXXV, 275, 1909.—Montana.

sudator O. S., West. Dipt., 307, 1877; Back, (l. c. 291).—Calif.

willistoni Curran, Can. Ent., LIV, 277, 1923. (Williston, Trans. Am. Ent. Soc., XI, 12 (sp.).—Wash., B. C., Alta., Colo., Ore.

UNDESCRIBED CANADIAN DOLICHOPODIDAE, WITH KEY TO CHRYSOTIMUS (DIPTERA)*

BY C. HOWARD CURRAN,
Ottawa, Ont.

Chrysotimus luteopalpus new species

Allied to *flavicornis* Van Duzee, but differs in the palpi being yellow, face of ♂ rather purplish in ground color; thorax nor front not bronzed. It differs from the specimen described as ♂ *pusio* Loew in having black palpi. The abdomen of both sexes is practically without pollen.

Length between 1.5 and 2 mm. *Male.* Face and front blue, rather thickly white pollinose, but not entirely concealing the ground color so that it appears somewhat purplish; ocellar triangle blue. Palpi yellow; proboscis brown Occiput more green, with thin whitish pollen. Ciliae of head pale yellow. Antennae yellow; third joint fuscous, subtriangular, the arista sub-basal, arising from a blackish dot; hair of third joint very conspicuous.

Thorax with the dorsum rather brassy green, moderately whitish pruinose, the pre-scutellar depression and scutellum slightly bluish tinged; pleura blue moderately white pruinose. Hairs wholly yellow.

Legs, including all the coxae, yellow, the last tarsal joint fuscous. Middle and hind femora each with one pre-apical bristle; their tibiae each with two bristles on the outer side in addition to the apical ones.

Wings scarcely yellowish, except basally. Crossvein slightly beyond the middle of the fifth vein and very slightly oblique.

Abdomen shining blue green, the base green; venter probably yellowish. Scarcely a trace of pollen. Hypopygium brownish, rather large for this genus, in the type, free, but apparently normally partly concealed.

Female. Face and front green sometimes with a bluish tinge; the occiput appears bluish in one specimen. Pleura green. Tarsi scarcely darker apically.

Abdomen wholly luteous, not pollinose, with a conspicuous fine yellowish hair laterally and apically. Squamae yellow with yellowish fringe, halteres yellow in both sexes.

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

Holotype—♂, Aweme, Manitoba, July 18, 1916, (N. Criddle); No. 552, in the Canadian National Collection.

Allotype—♀, same data.

Paratypes—♀ and 2 ♂, same data.

The species recorded from north of Mexico may be distinguished by the following table:

1. Basal two antennal segments yellow ..... 3.
   Antennae all black or brown ..... 2.
2. Palpi yellow ..... *delicatus* Loew.
   Palpi black or brown ..... *pusio* Loew.
3. Palpi yellow ..... *luteopalpus* n. sp.
   Palpi blackish ..... 4.
4. Thorax pale green with bright coppery reflections; pleura black ..... *flavicornis* Van Duzee.
   Thorax vivid green; pleura green ..... *pusio* (Lw.) Wheeler.

Dolichopus robertsoni n. sp.

Allied to *amnicola* but readily distinguished by the wholly yellow femora.

Length, 5 mm. *Male*. Face moderately wide, slightly narrowed in the middle; pale shining yellowish, becoming silvery white below. Front green, partly brassy, not noticeably pollinose; with a small bluish swelling at posterior angles of eyes. Infra-orbital ciliae yellowish, about ten of the upper pale. Antennae with the first two joints yellow with a black dorsal margin; third black, subcordate, less rounded below, its apex moderately acute; arista rising about the middle of the joint, plain.

Thorax bright green, conspicuously greyish yellow pollinose, leaving the middle stripe more shining in some lights; with a narrow stripe on either side of the middle line and a sublateral stripe on the median portion more or less cupreous. Pleura with greyish white pollen; chiefly of a more blue green tint.

Coxae all greenish black with narrow yellow apices, the front ones more shining greenish; all greyish white pollinose and with black hairs. Legs yellow; tip of hind tibiae and their tarsi wholly; front tarsi with the tip of their basitarsi and following joints wholly, and middle tarsi with the tip of the second, tip of third and last two joints entirely, black. Hind femora with row of conspicuous black bristly hairs on upper anterior surface, with two preapical bristles, the middle femora with one. Tarsi plain, the middle ones slightly compressed but lacking any ornamentation.

Wings apparently as in *amnicola*, but they have been wet. Squamae yellow, with black cilia. Halteres yellow.

Abdomen bright green, the disc more or less bronzed, thinly whitish pollinose, more noticeably so laterally. Hypopygium green, its broad upper margin and apex black. Lamellae of moderate size, obtusely oval, white, with narrow yellow margin on basal half, black margin apically, its margin regular, with six or seven projections, the apical ones long.

Holotype—♂ Baldur, Manitoba, July 29, 1922, (H. A. Robertson), No. 582, in the Canadian National Collection.

This is perhaps only a variety of *amnicola* but the legs are much more extensively yellow, cilia of hind femora longer and middle tarsi more compressed.

Parasyntormon emarginicornis n. sp.

Third antennal joint sub-rectangular, shallowly emarginate apically so that both the upper and lower corners are pointed; infra-orbital ciliae pale; ciliae of squamae black; second and third abdominal segments broadly yellow. Legs chiefly yellow; middle coxae with broad black stripe on outer side.

Length 4 mm. *Male.* Slender. Face very narrow, gradually widened upwardly, eyes shallowly emarginate opposite the antennae, the front widened behind. Face yellowish brown, greyish white on lower third. Front rather dull brownish green, moderately greyish pollinose, above with brownish pollen; upper ciliae black; ciliae pale yellowish on lower three-fourths. Antennae black, first two joints narrowly yellow below; first joint two and one-quarter times as long as wide, gradually widened to apex; second joint nearly twice as long as wide. Third joint nearly twice as long as wide, its basal corners rounded, its apical corners sharply rounded, prominent, its apex rather conspicuously concave; joint a little wider basally. Arista sub-basal, first joint about four times as long as wide, tapering, its base again narrowed. Palpi obscure yellow, with silvery white pollen, not large.

Thorax shining green; mesonotum rather dull brownish, with the side margins and four equal stripes more shining dull green, the median stripes abbreviated behind, the lateral ones in front. Bristles and hairs black. Pleura white pollinose; with two bristles on propleura just above the front coxae.

Legs yellowish; tarsi brown, the basitarsi yellow except their apices. Coxae yellow, the middle ones greenish exteriorly; all clothed with black hairs, the front ones with some fine white hairs inwardly; middle and hind coxae with a black exterior bristle near the middle. Legs black haired; the front femora with a row of long sparse, fine bristles below anteriorly and a row on the basal half posteriorly, posterior four each with a preapical bristle on front surface. Tibiae with a spine on outer basal fourth; the middle and hind ones with one on anterior surface at about the basal fourth and another beyond the middle and the hind tibiae bear a more or less distinct row of bristles on outer posterior line. Legs simple; first joint of hind tarsi four-fifths as long as second.

Wings greyish hyaline; costa simple; last section of fourth vein curved forward from basal third, apically parallel with third vein; anal cell rectangular; allulae not differentiated (rudimentary); posterior base of wing with fine whitish hairs. Squamae yellow, with black ciliae. Halteres yellow, stem whitish.

Abdomen bronzed; the base of the segments blackish; first segment more greenish; second and third segments with a large, basal yellow triangle on each side, their inner ends rounded, reaching narrowly to the apex of the segment at the sides. Hair all black. Genitalia small; lamellae short, slender; claspers triangular, shining black. Hair on lamellae black.

Holotype— ♂. Banff, Alta., July 26, 1922, (C. B. D. Garrett). No. 580, in the Canadian National Collection.

This species is allied to *occidentale* Aldrich and I had identified it as that species in the absence of typical specimens. Dr. Aldrich pronounced it as undescribed when we compared specimens. It differs from that species by having the second antennal joint narrower and less acute and in more conspicuous points at apex of third joint, etc.

THE BEE-GENUS DIALICTUS

BY GRACE SANDHOUSE,
University of Colorado, Boulder, Colo.

There has been some question regarding the metallic-colored Halictine bees with two submarginal cells,—whether they should be classed as a separate genus *Dialictus,* or considered as derivative forms from different types of *Chloralictus,* the supposed genus therefore polyphyletic. Unfortunately, these bees have never been collected in quantities sufficient to permit an extensive investigation into their anatomical structure; and, until such an investigation has been made and the results thus obtained considered, it seems rather useless to depart from the nomenclature now in use.

The fact that sometimes a specimen may have two submarginal cells on one side and three on the other indicates the instability of the supposed generic character. In a discussion of *Chloralictus parvus* (Cresson), Baker stated that in his collection from all Cuba all the males and three-fourths of the females had but two submarginals. He also noted that sometimes the number of submarginals varied in the different wings of one specimen. In the present collection the writer found this to be true in one male *D. occidentalis* Crawford. Cresson evidently had similar specimens, for he described *D. parvus* as *Augochloral parva*—with three submarginals—and as *Panurgus? parvus*—with two. Should further investigation support the view that the group is polyphyletic, the genus *Dialictus* would then have to be abandoned and the species referred to *Halictus* or *Chloralictus.*

The following key includes all the known North American species of Dialictus except two from the West Indies—*D. parvus* (Cr.) and *D. subcyaneus* (Ashmead). The key was compiled from direct observation of specimens except in the case of *halictoides* Fox and *costaricensis* Crawford.

DIALICTUS

Males ..... 1.
Females ..... 4.

1. Tegulae punctured (New Mexico) ..... *stictaspis* n. sp.
   Tegulae not punctured ..... 2.
2. Slender species; mesothorax almost without punctures (Colorado) ..... *lionotus* n. sp.
   More robust; mesothorax closely punctured ..... 3.
3. Flagellum dark, comparatively short; abdomen not punctured (Colorado) ..... *anomalus* Robertson.
   Flagellum longer, yellow testaceous beneath; abdomen punctured (New Mexico) ..... *occidentalis* Crawford.
4. Abdomen testaceous (Lower California) ..... *halictoides* Fox.
   Abdomen not testaceous ..... 5.
5. Tegulae punctured (San Jose, Costa Rica) ..... *costaricensis* Crawford.
   Tegulae not punctured ..... 6.
6. Wings clear; head and thorax brilliant blue; abdomen punctured (Colorado and New Mexico) ..... *occidentalis* Crawford.
   Wings dusky; head and thorax darker; abdomen not punctured ..... 7.
7. Abdomen greenish; mesothorax dull and closely punctured (Guatemala) ..... *onustulus* Cockerell.

Abdomen black; mesothorax somewhat shining and less closely punctured ..... 8.

8. Slender species; head narrow; mesothorax dark blue; disk of propodeum finely granular (New Mexico) ..... *theodori* Crawford.

Robust species; head broad; mesothorax brassy green; disk of propodeum plicate (Colorado) ..... *anomalus* Robertson.

The following is a list of the species included in the genus *Dialictus*. The localities cited are additional to those previously listed.

Dialictus occidentalis Crawford

Dialictus occidentalis Crawford. Can. Ent., 1902, p. 318.
Halictus galei Cockerell. Can. Ent., 1919, p. 272.

The writer examined the type specimen of *H. galei* and it was found to agree with named specimens of *occidentalis*. Furthermore, Mr. Rohwer of the U. S. National Museum kindly compared the description of *galei* with the type of *D. occidentalis* and found no difference.

COLORADO: 10 ♀s, Boulder, April 8 to May 24, at flowers of *Taraxacum taraxacum, Salix, Drymocallis, Linum lewisii;* ♀ Manitou, at *Ribes leptanthum* (T. and W. Cockerell); ♀, Gold Hill, July 12, '19 (T. and W. Cockerell).

NEW MEXICO: 2 ♀s, Santa Fe, Aug. (Cockerell, Nos. 4110 and 4231) ♀, Las Vegas, July 29, at *Verbesina exauriculata* (Cockerell); ♀, East Las Vegas, April 24, '02, at *Taraxacum* (Eldon Tuttle and Leo Tipton); ♀, Hot Springs, May 17, '03, at *Taraxacum* (Cockerell); ♂, Santa Fe, Sept. 2, Cockerell, No. 5610; 5 ♂s Pecos, July, at *Clematis ligusticifolia* (T. W. Cockerell).

Dialictus theodori Crawford

Dialictus theodori Crawford. Can. Ent., 1902, p. 318.

1 ♀, Pecos, New Mexico, July 9, (W. P. Cockerell).

Dialictus costaricensis Crawford

Dialictus costaricensis Crawford. Trans. Am. Ent. Soc. XXXIII. 1906, p. 163.

Dialictus halictoides (Fox)

Panurgus halictoides Fox. Proc. Calif. Academy of Science 2d. Ser., Vol. IV., 1893, pp. 15 and 113.

Dialictus subcyaneus (Ashmead)

Dufourea subcyanea Ashmead. Trans. Ent. Soc. London, 1900, p. 215.

Dialictus onustulus Cockerell

Dialictus onustulus Cockerell. Annals and Magazine of Natural History, Ser. 8, Vol. X., 1912, p. 318.

2 ♀'s, Guatemala City, Guatemala (W. P. Cockerell).

Dialictus anomalus (Robertson)

Halictus anomalus Robertson. Am. Nat. Vol. XXVI., 1892, p. 272.

COLORADO: 13 ♀'s, Boulder, April 29 to Aug. 9, and 1 ♂, Aug. 1 at flowers of *Besseya plantaginea, Monarda, Phacelia, Solidago*. (W. P. Cockerell and S. A. Rohwer).

Dialictus parvus Cresson

Augochlora parva (Pocy MSS.) Cresson. Proc. Ent. Soc. Phila. 1865, p. 171.
Panurgus? parvus Cresson. Proc. Ent. Soc. Phila. 1865, p. 175.
Chloralictus parvus (Pocy) Baker. Primer Informe Annal de la Estacion Central Agronomica de Cuba, 1906, p. 259.

Dialictus lionotus sp. nov.

Male—About 4 mm. long; head and thorax shining, very dark blue-black;

facial quadrangle almost as broad as long; orbits converging slightly below; eyes comparatively short; face smooth, shining, with piliferous punctures only; supraclypeal area and clypeus black; a distinct groove down the middle of the front, below the ocelli; antennae comparatively long; flagellum dark testaceous, yellow testaceous beneath; mesothorax and scutellum smooth, almost without punctures; disk of propodeum without a distinct enclosure, microscopically tessellate between the plicae; mesopleura with few shallow punctures; metapleura with irregular transverse ridges; truncation poorly defined laterally; tegulae very pale, impunctate; thorax and abdomen with very sparse white pubescence; abdomen black, polished, narrowly ovate, impunctate, apical margins of segments testaceous; wings dusky; anterior wing 3 mm. long; stigma and nervures dull testaceous; basal nervure strongly bent; second submarginal cell of the left wing of the type specimen receiving the first recurrent nervure near the base and the second near the apex, in the right wing the second submarginal receives the first recurrent nervure about one-fourth of the distance from the base and the second as in the left wing; legs black, knees, apices of tibiae and the tarsi light ferruginous.

Habitat: Colorado, (Baker, No. 1596).

Known from the type specimen only. The antennae were accidentally broken after the description had been written. It is easily distinguished from all other *Dialictus* and *Halictus* by the lack of punctation, the short eyes, and the very gentle truncation.

Dialictus stictaspis sp. nov.

Male—About 5 mm. long; pubescence white; head and thorax brilliant steel blue; facial quadrangle somewhat longer than broad; orbits converging sharply below; antennae brown, the flagellum ferruginous beneath; face clothed with dense pubescence; front above the antennae closely punctured, the punctures becoming more sparse below; thorax with moderately dense pubescence; mesothorax polished, coarsely punctured, the distance between punctures about twice the diameter of a puncture; punctation of the scutellum similar to that of the mesothorax; disk of propodeum crescentic, microscopically lineolate between the rugae which reach the apex; mesopleura coarsely and closely punctured; metapleura with irregular shallow punctures; sides and posterior part of propodeum punctured; truncation poorly defined laterally; tegulae dark, punctured; abdomen subcylindrical, dark brown, apical margins of the segments polished testaceous, the remainder of the segments with delicate piliferous punctures; wings hyaline; stigma and nervures testaceous; second submarginal cell receiving the first recurrent nervure about one-third of the distance from the base, and the second about one-fifth from the apex; anterior wing 3.5 mm. long; the second submarginal cell about as large as the first; legs dark brown, with rather sparse pubescence; tarsi slightly paler.

Habitat: Mesilla, New Mexico, June, (Cockerell).

The bees here considered, except where otherwise stated, are all in the collection of Professor T. D. A. Cockerell and the types will eventually be placed in the U. S. National Museum. The writer is greatly indebted to Professor Cockerell for the use of his material and literature, as well as for helpful criticisms and suggestions.

ADDITIONS TO THE LIST OF THE COLEOPTERA OF NORTHERN ALBERTA

BY F. S. CARR,
Medicine Hat, Alta.

CICINDELIDAE

526. *Cicindela edmontonensis* Carr. 9-V-18.

CARABIDAE

527. *Loricera caerulescens* Linn. 12-V-19.
528. *Dyschirius erythrocerus* Lec. 30-VII-21.
529. *Bembidion dentellum* Thunb. 7-V-17.
530. *Bembidion transversale* Dej. 4-X-20.
531. *Rembus undulata* Carr. 27-IV-18.
532. *Platynus corvus* Lec. 9-V-19.
533. *Platynus gemellus* Lec. 3-VI-18.
534. *Lebia pulchella* Dej. 21-IV-19.

HALIPLIDAE

535. *Peltodytes tortulosus* Roberts. Redwater 20-VI-22.

DYTISCIDAE

536. *Coelambus patruelis* Lec. 9-IV-16.
537. *Coelambus sellatus* Lec. Tofield, 25-VIII-22.
538. *Coelambus unguicularis* Cr. Tofield. 25-VIII-22.
539. *Coelambus canadensis* Fall. 13-VI-17.
540. *Coelambus puncti-lineatus* Fall. Tofield, 25-VIII-22.
541. *Coelambus oregonus* Fall. 10-VII-17.
542. *Deronectes depressus* Fabr. 29-VIII-19.
543. *Hydroporus consimilis* Lec. Castor, 9-X-20.
544. *Hydroporus sericeus* Lec. Castor, 9-X-20.

GYRINIDAE

545. *Gyrinus opaccus* Sahl. 10-V-20.
546. *Gyrinus picipes* Aube. Jasper, 13-IX-22.

HYDROPHILIDAE

547 *Helophorus oblongus* Lec. 6-V-22.

STAPHYLINIDAE

548. *Tachinus memnonius* Grav. 29-VIII-19.
549. *Bolctobius cincticollis* Say. 27-VII-19

PSELAPHIDAE

550. *Euconnus similis* Blatch. 28-VI-19.

HISTERIDAE

551. *Saprinus lugens* Er. 28-VI-20.

LYCIDAE

552. *Calochromus perfacetus Say*. Edwand, 20-VI-22.

LAMPYRIDAE

553. *Phausis riversi* Lec. 24-VI-20 (Det. by Mr. Barber).

CLERIDAE

554. *Hydnocera lecontei* Wolcott. Redwater 30-VI-22, on jackpine.

MORDELLIDAE

555. *Mordellestina pustulata* Melsh. 17-VI-20.

MELOIDAE

556. *Epicauta cinerea* Forst. Fort Saskatchewan, 10-VI-22.
557. *Macrobasis subglabra* Fall.

BUPRESTIDAE

558. *Buprestis sulcicollis* Lec. Edwand, 14-VI-22. On jackpine.

HELMIDAE

559. *Helmis vittata* Melsh. 23-VII-21.

HETEROCERIDAE

560. *Heterocerus tristis* Mann. 7-VIII-22.

OSTOMIDAE

561. *Tenebroides dubia* Melsh. Castor, 11-IX-20.

COCCINELLIDAE

562. *Hippodamia sinuata* Mulst. 8-VIII-19.
563. *Hippodamia convergens* Guer. 14-VI-19.
564. *Brachyacantha uteela* Casey. 5-IX-21.
565. *Brachyacantha illustris* Casey. 13-V-22.
566. *Scymnus naviculatus* Casey. 18-VI-19.

ANOBIIDAE

567. *Sitodrepa panicea* Linn. 13-III-20. In onion seed.

CERAMBYCIDAE

568. *Anthophilax mirificus* Bland. Hillcrest, 19-VI-20.
569. *Judolia sexmaculata* L. 26-VI-18.
570. *Brachyleptura cribripennis* Lec. 27-VII-22.
571. *Leptura nigrella* Say. Edwand, 14-VI-22. On jackpine.
572. *Monochamus oregonensis* Lec. Jasper, 13-IX-22. Ovipositing on *Pinus contorta.*
573. *Leiopus variegatus* Hald. 18-VII-21.

CHRYSOMELIDAE

574. *Donacia magnifica* Lec. 12-VII-22. On arrowhead.
575. *Donacia distincta* Lec. 18-VI-18.
576. *Lema brunnicollis* Lec. 29-VII-18.
577. *Galerucella tuberculata* Say. 29-VII-22.
578. *Disonycha xanthomelaena* Darm. Mundare, 10-VI-22.
579. *Chaetocnema perturbata* Horn. 13-VII-22.
580. *Chaetocnema protensa* Lec. 10-IX-19.
581. *Phyllotrete albionica* Lec. 5-VIII-22.

MYLLABRIDAE

582. *Mylabris fraterculus* Horn. 3-VII-19.

CURCULIONIDAE

583. *Hyperodes humilis* Gyll. 6-VI-18.
584. *Dorytomus parvicollis* Casey. 9-VII-15.
585. *Dorytomus vagenotatus* Casey. IV-21. On poplar trunks.
586. *Elleschus scanicus* Payk. 10-IV-15. In willow flowers.
587. *Elleschus borealis* Carr. 24-V-19. In willow flowers.
588. *Phthorophloeus piceae* Swaine. 2-IX-16.

It is to be noted that, unless otherwise indicated, the locality of capture is Edmonton, Alberta.

NOTES ON THE AUTHORSHIP OF CERTAIN NAMES (LEPID.: PHALAENIDAE)

BY WM. BARNES and F. H. BENJAMIN,
Decatur. Ill.

Strecker, 1874, Lep. Rhop. & Het., p. 94, states: "Dr. Herman Behr lately had the kindness to send me the types of his following unpublished Californian species:"; then follow short descriptions of *"Dryobota Californica,* Behr, Mss.," *"Taeniocampa Paviae,* Behr, Mss.," *"Cosmia Sambuci,* Behr, Mss.," *"Cucullia Solidaginis* Behr, Mss.," *"Cucullia Matricariae,* Behr, Mss.," and *"Plusia Echinocystidis,* Behr, Mss."

Under the present International Rules of Zoological Nomenclature, these names will apparently have to be credited to Strecker, as the descriptions are obviously by the author and not by Dr. Behr. This is a parallel case to the name *"Plusia lenzi,"* now generally credited to French and which was described as a Behr manuscript species.

The original orthography of *matricariae* and *echinocystidis* should be preserved. It may be of interest to note that Dr. Behr apparently distributed specimens of the last mentioned labelled *echinocystis,* which accounts for that name in the literature; while Strecker, 1900, Lep. Rhop. & Het., Suppl. 3, p. 33, spells the name *echinocystides.*

EXTENDED PUPAL DURATION

Mr. R. R. Rowley of Louisiana, Mo., writes that in May, 1915, he received from southern Texas two dozen cocoons of *Rothschildia jorulla,* collected in the autumn and winter preceding (1914). From these cocoons he obtained fourteen moths, nine males and five females. The first moth emerged October 4th, 1915; the second, October 9th, 1916; the third, October 10th, 1916; the fourth, October 16th, 1916; the fifth, July 9th, 1917; the sixth, September 20th, 1917; the seventh, April 25th, 1918; the eighth, May 2nd, 1918; the ninth, August 12th, 1918.

Of the thirteen remaining cocoons some had died, some had given parasitic hymenoptera, but three were still heavy and promising. However, as he hardly expected to get anything further from the cocoons, he gave the above information to the Editor of "The Canadian Entomologist" and it was published in that Journal November, 1918.

To his surprise, a twelfth moth emerged May 14th, 1919, but that was not the end, as the thirteenth crawled out of its cocoon on June 30th, 1919. The last cocoon was still heavy, but did not give up its occupant till July 9th, 1922, after a prison term of eight years. The first moth (October 14th, 1915) was a small male; the last (July 9th, 1922) was a medium sized female.

CHANGE OF NAME

The name *"Chilosia similis"* having been used by Michl. (Ver. Zool.-Bot., Ges. Wien, 1911) for a European species, I propose the name *"Cartosyrphus shannoni"* for the species described by Shannon (Proc. Biol. Soc. Wash., XXIX, 196, 1916). Notwithstanding the fact that the latter is now placed in the genus *Cartosyrphus,* while the former is a true *Chilosia,* this change is necessary.

C. H. CURRAN.

The Canadian Entomologist

VOL. LV. ORILLIA, SEPTEMBER, 1923. No. 9.

MORE NOTES ON FUNGOUS INSECTS*

BY HARRY B. WEISS,

New Brunswick, N. J.

An effort to bring together additional data concerning insects and fleshy fungi has resulted in the following notes. In Entomological News (March, 1923, p. 86) Mr. M. L. J. Higgins records the capture of a large number of the nitidulid beetle *Oxycnemus histrina* in the stink horn fungus *Phallus impudicus* at Mulhall Station, Virginia, on September 23. Champlain and Knull in the Canadian Entomologist (May, 1922, p. 104) state that the curculionid beetle *Otidocephalus myrmex* (Hbst.) feeds on the pustules of the sycamore blight, *Gnomonia veneta*. Writing about the occurrence of the European fly *Muscina pascuorum* Meig., in North America, Johnson (Psyche, Vol. XXX, No. 1, pp. 1-5) states that Schiner (Fauna Austriaca I, 597) says that "Bremi found the larvae in *Agaricus citrinus*."

Recently Mr. Chas. Dury identified for me specimens of the beetle *Plesiocis cribrum* Csy., which were bred from *Polyporus volvatus* collected by Mr. R. D. Hartman on *Pinus coulteri*, October 7, at Mt. Hamilton, California, and *Cis vitula* Mann., bred from *Polyporus versicolor* collected by Mr. Hartman on *Umbellularia californica*, November 8 at Palo Alto, California.

Upon looking into European literature one finds that whereas many species of insects are listed as occurring on fungi the specific names of the hosts are rarely given. In the "Coleoptera of the British Islands" by Fowler, *Cis punctulatus* Gyll. is mentioned as inhabiting *Polyporus abietinus* on Scotch fir and *Cis lineatocribratus* Mell. as being found in *Polyporus nigrinus* on birch. Several references to other European records are noted in former papers on fungous insects.

LEPIDOPTERA

In Meyrick's "Handbook of British Lepidoptera," the following species whose larvae live mainly on lichens, are listed. Seventeen of the twenty-four species noted belong to the family *Tineidae*. According to Bruce Fink, a lichen "is a fungus usually if not always more or less parasitic during all or part of its life upon an algal host and also sustains a relation to an organic or inorganic substratum."

Caradrina exulis Lef. Larva in stems and amongst roots of grass and amongst lichens.

Cleora lichenaria Hufn. Larva on lichens.

Selidosema glabraria Hb. Larva on lichens.

Tephronia sepiaria Hufn. Larva on lichens growing on walls.

Acanthophila alacella Dup. Larva on lichens on tree trunks.

*—For previous paper on fungous insects see—Proc. Biol. Soc. Wash. vol. 33, pp. 1-20; vol. 34, pp. 59-62; vol. 34, pp. 85-88; vol 34, pp. 167-172; vol. 35, pp. 125-128; Canadian Ent. Sept., 1922, pp. 198-199; Amer. Nat. vol. LIV, pp. 443-447.

Symmoca signatella H. S. Larva has been stated to feed on lichens.
Acompsia flavifrontella Hb. Larva on lichens and dead leaves.
Oinophila v-flavum Hw. Larva in silken galleries amongst fungus growing on walls in cellars.
Fumea intermediella Brd. Larva on grass, lichens etc.
Fumea betulina Z. Larva on lichens growing on bushes.
Fumea sepium Spr. Larva on lichens growing on trees.
Solenobia inconspicuella Stt. Larva on lichens growing on fences and tree trunks.
Solenobia Douglasii Stt. Larva on lichens growing on fences, rocks, etc.
Taleporia pseudobombycella Hb. Larva on lichens on fences and tree trunks
Narycia melanella Hw. Larva on lichens on fences and tree trunks.
Diplodoma marginepunctella Stph. Larva on dead insects, fungus, etc.
Scardia boleti F. Larva in fungus.
Tinia corticella Curt. Larva in fungi growing on trees.
Tinea parasitella Hb. Larva in fungi growing on trees.
Tinea arcuatella Stt. Larva in fungi growing on trees.
Tinea confusella HS. Larva probably on lichens.
Tinea misella Z. Larva on dried plant stems, fungi, etc.
Tinea vinculella HS. Larva on lichens on rocks.
Tinea argentimaculella Stt. Larva in galleries amongst lichens on rocks.

Figure 1. *Polyporus betulinus*, specimen at left showing injury to lower surface and interior by the beetles *Diaperis maculata* and *Thymalus fulgidus*. These beetles breed in the fungus.

Dr. William G. Dietz in his "Revision of the Genera and Species of the Tineid Subfamilies Amydriinae and Tineinae Inhabiting North America" (Trans. Am. Ent. Soc. Vol. XXXI, No. 1) mentions *Tinea oregonella* Busck, *Tinea multistriatella* Dietz and *Tinea rileyi* Dietz as being bred from fungi but does not record the species.

ISOPTERA.

Banks and Snyder in their "Revision of the Nearctic Termites" (U. S. Nat. Mus. Bul. 108) mention that H. G. Hubbard found a colony of *Kalotermes minor* Hagen "on March 1, 1897, at Palm Springs, California. This was a small colony of about 40 to 50 individuals in an old *Polyporus* fungus on a cottonwood or willow tree." They also state that Schwarz found a colony of *Constrictotermes cinereus* Buckley "under a large *Polyporus* lying on the ground at San Diego, Texas.

Wheeler, writing recently in the "Scientific Monthly," (Vol. XVI, No. 3, 1923) under the title "Social Life Among the Insects" states that Petch, who has studied the fungi cultivated by the termites *Odontotermes redmanni* and *obscuriceps* in Ceylon finds that they belong to at least two species, *Volvaria eurhiza* and *Xylaria nigripes*. Petch in his paper "The Fungi of Certain Termite Nests" (Ann. Bot. Gard. Peradeniya 3 (1906) 185-270, f. 3) writes that *Xylaria nigripes* occurs in the same situation in Ceylon, Java, Madagascar and probably Brazil, and that *Xylaria furcata*, which is a form of *nigripes*, occurs in Ceylon and Java, also that *X. nigripes* has been recorded from other countries without any reference to its connection with termite nests. In Ceylon neither *X. nigripes* nor *X. furcata* are found except growing from termite nests. Another species, *Sclerotum stipitatum* (*Sclerotium subterraneum*, Blanco M. Fl. Filip. ed. 2 (1845) 584) is mentioned by Petch as being found in termite nests in India, Ceylon, Java and Africa. Concerning *Collybia albuminosa*, which grows from actual combs in termite nests, Petch states that "the occurrence of agarics in or around termite nests has been recorded from Ceylon, India, Singapore, Java, Borneo and Brazil. The species in question is usually regarded as edible."

William H. Brown in the "Philippine Journal of Science" (C. Botany, Vol. 13, No. 4, pp. 223-231, pls. 3, 4) under the title,, "The Fungi Cultivated by Termites in the Vicinity of Manila and Los Banos" mentions *Collybia albuminosa*, *Xylaria nigripes* and *Xylaria furcata*.

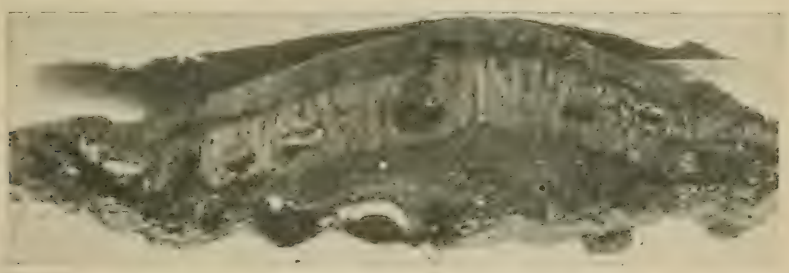


Figure 2. Section through *Fomes applanatus* showing work, larvae and adults of *Bolitotherus cornutus*.

HYMENOPTERA

Wheeler, in his book "Ants, Their Structure, Development and Behaviour," devotes chapter XVIII to the fungous-growing ants. In his article in the "Scientific Monthly" (Vol. XV, No. 6, 1922, p. 536) he has the following to say: "That the fungi cultivated by the various Attiini belong to several different genera is shown by Bruch and Spegazzini, who have recently been able to identify the mushrooms of the fungi cultivated by several Argentinian Attiini. *Acromyrmex lundi*, e.g., cultivates *Xylaria micrura* Speg., *Moellerius heyeri*, *Poromiopsis bruchi* Speg., and *Atta vollenweideri*, a gigantic agaric *Locellina Mazzuchii* Speg." "*Cyphomyrmex rimosus* cultivates a very peculiar fungus (*Tyridiomyces formicarum* Wheeler)." Wheeler states that whereas fungus-growing ants are exclusively American, the fungus-growing termites are all confined to the Ethiopian and Indomalayan regions.

A NEW SPECIES OF RHEUMATOBATES FROM TEXAS (HETEROPTERA, GERRIDAE)*

BY GRACE OLIVE WILEY,

St. Paul, Minn.

Rheumatobates hungerfordi new species

Velvety-black, covered with a bluish-white bloom except on head, pronotum with a large yellow spot occupying the entire length, in some specimens quadrate, in others twice as wide as long with sides rounded, while in some the spot covers the entire disk of pronotum; mesonotum with a large median yellow spot, almost quadrate, or diamond-shaped in some specimens, while in others it is roughly the shape of an inverted heart. Connexivum of male, yellow for at least half of its apical length; connexivum of female, yellow along outer half for nearly its entire length. These colors vary in the different individuals. In all specimens there is present, just above the base of the acetabula or intermediate coxal cavity, a small yellow spot, varying somewhat in shape from round to quadrate. No ocelli present in either sex.

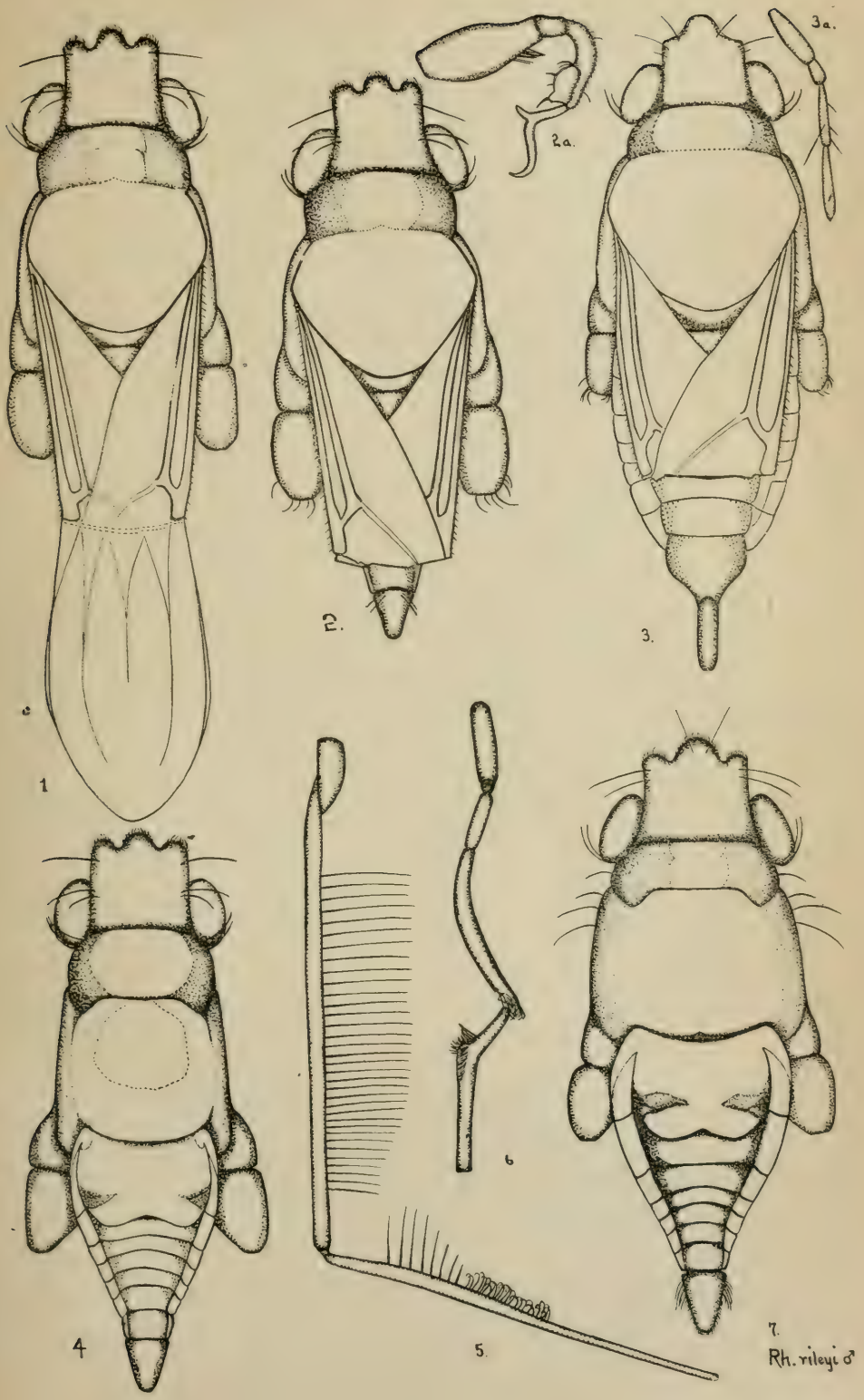
Apterous male: Head shorter than *Rh. rileyi* Bergr. and *Rh. tenuipes* Mein., narrower than *Rh. rileyi* and nearly the same width as *Rh. tenuipes.* Width of head across eyes .88 mm.

Antennae: Brownish-black, pale at base, segments I, .67 mm. in length, small at base and increasing in size to near the middle, then decreasing to apex, which is about the same as base; adorned on the outer, under side near apex with a brush composed of rather stiff coarse hairs glued together, and just beneath with a scattered bunch of coarse hairs about the same length as brush, and from this there extends almost to base of segment a row of long, fine, semi-erect hairs; these hairs are light in color and are not easily noticed unless seen from a certain angle. Segment II, .15 mm. in length, more slender than segment I at apex and not bearing a spine or tubercle. Segment III, approximate length .60 mm., strongly curved on basal half, large fossa or pit occupying nearly entire length of apical half, and extending a little beyond insertion of segment IV; this pit longer and wider than in *Rh rileyi* Bergr. and *Rh. tenuipes* Mein. Segment IV, .62 mm. in length, curiously bowed, having a stout, thick spur just before the middle which apparently is on the ventral surface, apical half strongly curved (Pl. 10, fig. 2a).

Thorax: Pronotum .36 mm. in length, mesonotum .73 mm. in length; pronotum nearly twice as long as that in apterous male of *Rh. rileyi* Bergr., but much narrower; mesonotum not as broad nor as long as in *Rh. rileyi;* abdomen considerably narrower and somewhat shorter than in *rileyi,* also different in form. Sometimes a yellowish spot occupies the apical half of the last abdominal segment and basal portion of the genital segment.

Legs: *Anterior legs* much the same in structure as *Rh. riley* Bergr. and *Rh. tenuipes* Mein.; femora pale yellowish, dark at apex, tibiae and tarsi brownish-black. *Intermediate legs*: Coxae much incrassated and larger than the slender posterior coxae; length of femora 2.4 mm., straight, fringed on inner side with long, straight hairs, about thirty in number (varies 28-38) and of nearly

*—Contribution from the Department of Entomology, University of Minnesota.


1
2.
2a.
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3a.
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6
7.
Rh. rileyi ♂

equal length throughout (Pl. 10, fig. 5); tibiae 2.07 mm. in length, nearly straight, thicker on basal half, adorned on inner side with four long, straight hairs and three or four shorter ones, followed by many short, upwardly curled hairs which terminate at slightly beyond middle; tarsi 1.78 mm. in length. Color: coxae pale yellowish, apex or apical half dark, trochanters pale, femora brownish-black; tibiae and tarsi also brownish-black. *Posterior legs*: Coxae and trochanters pale yellowish, slender and linear, trochanters dark at apex; length of femur .87 mm., brownish-black in color, strongly arcuate, of nearly equal thickness throughout, but stouter apically than at base, devoid of long hairs except at apex where a few are curled around the tip; tibiae .96 mm. in length, brownish-black, joint nearly at right angles to the outer side of femur, on basal half much incrassated and angulately-elbowed, adorned with a stiff brush of rather long, coarse hairs, apical half of tibiae straight and of nearly equal thickness; tarsi 1.42 mm. in length and brownish-black in color.

Apterous female: Longer and more robust than male, except head, which is smaller and narrower across the eyes. Antennae slender, resembling the female antennae of *Rh. rileyi* Bergr. and *Rh. tenuipes* Mein. Pronotum .24 mm. in length, shorter and slightly narrower than in the male, and nearly one-third longer than pronotum of apterous female *Rh. rileyi* Bergr.; length of mesonotum .70 mm., being shorter and wider than male; length of abdomen 1.71 mm., longer and wider than male, and shorter than apterous female *Rh. rileyi* Bergr.; mesosternum brownish-yellow, variable, sometimes with anterior margin and two posteriorly diverging bands, dark brown, in this respect similar to female of *Rh. tenuipes* Mein.; first genital segment usually with median oblong yellow spot occupying apical three-fourths of the segment. Legs much the same as females of *Rh. rileyi* Bergr. and *Rh. tenuipes* Mein. Sometimes there is a small yellow spot on the last abdominal segment near its apical margin.

Macropterous male: Head, eyes and antennae similar to apterous male; pronotum with yellow spot, mesonotum velvety-black and without yellow spot; pronotum not separated from mesonotum by a visible suture.

Hemelytra: Bluish-white, the veins prominent and very dark brown in color; membrane smoky-brown, extending from impressed line to far beyond tip of abdomen, this indentation or groove crossing the hemelytra from edge to edge, being outwardly curved along middle.

Macropterous female: Head, eyes and antennae similar to that of apterous female; mesonotum without yellow spot. Hemelytra same as macropterous male.

Nymphs: The nymphs have the same color markings as the adults. Differences between the sexes can be told by a glance at the genital segments, and the males of at least the third instar on, can be distinguished by the peculiar swellings of the posterior tibiae and the first and third antennal segments.

This species has the habit of breaking off the long wing membrane as recorded by *Torre-Bueno* (Ohio Naturalist, Vol. VIII, 1908) in other Halobatinae.

These insects were taken in quiet eddies of swiftly flowing streams, and in still pools and ponds, and were always found in company with *Trepobates pictus*. The winged forms are very agile and hard to capture; they have a habit when disturbed of skimming over the surface of the water in astonishing leaps

and bounds, no doubt aided by their wings even when truncated. The bluish-white hemelytra of the winged individuals and the bloom and yellow markings on pronotum and mesonotum of the apterous ones, make them very conspicuous for such small bugs. No doubt all specimens are covered with bloom, but in the specimens examined it does not occur on the head, nor on the mesonotum of the macropterous forms.

Holotype: apterous male, collected near Rock Island, Texas, Aug. 2, 1922 (Grace O. Wiley); in author's collection.

Allotype: taken at type locality, June 27, 1922 (Grace O. Wiley).

Morphotypes: (macropterous form) male collected June 6, 1922, at type locality; female collected May 23, 1922, at type locality (Grace O. Wiley).

Paratypes: 6 specimens taken with the type; numerous specimens taken from April to Sept. 15, 1922, near Rock Island and June 14—16, Galveston, Texas, a few specimens taken near Cisco, Texas, June, 1921, collected by the writer.

Paratypes deposited in the collections of the University of Minnesota, the University of Kansas, and in the collections of Mr. William E. Hoffman and the writer.

I propose the name *hungerfordi* for this species, in honor of Dr. H. B. Hungerford, because of his great interest in water-bugs which was an incentive to the writer in the study of this remarkable group.

EXPLANATION OF PLATE.

1. *Rh. hungerfordi* n. sp., Macropterous male.
2. *Rh. hungerfordi* n. sp., truncate-winged male.
2a. Male antennae *Rh. hungerfordi,* (segments III-IV twisted to show fossa).
3. *Rh. hungerfordi* n. sp., macropterous female with truncate wings.
3a. Antennae of female *Rh. hungerfordi* n. sp.
4. *Rh. hungerfordi* n. sp., apterous male, drawn from type.
5. Intermediate leg of ♂ *Rh. hungerfordi* n. sp.
6. Posterior leg of ♂ *Rh. hungerfordi* n. sp.
7. *Rh. rileyi* Bergr., apterous male.

SOME COLORADO BEES

BY T. D. A. COCKERELL,

Boulder, Colo.

Xenoglossa pruinosa Say, var. lutzi n. var.

Female with end of abdomen more or less reddened, and the pubescence on fifth and sixth segments (except the light hair at extreme sides) very brilliant ferruginous-red. Male ordinary, except that one specimen out of 25 has no yellow spot on clypeus.

Grand Junction, Colorado, 2 ♀, 25 ♂; August 3, 1920 (Lutz 4758 and 4758 B); Alt. prox. 4,500 ft.

Osmia holochlora sp. n.

Male. Length about 8.5 mm., similar to *O. bennettae* Ckll., to which it

runs in my ms. table, but certainly distinct, differing thus: entirely very bright yellowish-green, with purple tints; hair of head and thorax pure white, shining; face, tegulae and anterior part of thorax with strong golden tints; mesothorax more coarsely rugosopunctate; hair of mesopleura shorter; wings not distinctly brownish; tarsi with last joint dark red; sixth abdominal segment deeply emarginate (seventh similarly emarginate. Other characters are antennae black; mandibles with a green spot; tegulae golden-green; apical part of abdomen with black hair above. Easily known from *O. bella* Cress. by the entirely pure white hair of head and thorax above.

Minnehaha, Pike's Preek, Colorado, at flowers of *Pentstemon gracilis,* June 13, 1918. (Frances Long.) U. S. National Museum.

I take this opportunity to note that *Osmia nassa* Ckll., described from California, extends to Utah. The U. S. National Museum has a ♀ from Salt Lake City, June 13, 1899.

Osmia pusilla Cresson was based on the male, from Pike's Peak, Colo. In June, 1918, Miss Frances Long collected six of these males at flowers of *Mertensia pratensis,* at Minnehaha, Pike's Peak. In the same month, at the same flowers, she got one *O. pentstemonis* Ckll., one *O. albolateralis* Ckll., two *O. melanotricha* Lovell & Ckll., and two *O. hypoleuca* Ckll., all females. I think it is practically certain that *O. melanotricha* is the female of *O. pusilla.* In the same locality and month, but at flowers of *Pentstemon gracilis,* Miss Long obtained 3 ♀, 1 ♂, of *O. pentstemonis* Ckll., and one ♀ of *O. rohweri* Ckll. The male of *pentstemonis* is new; it looks much like the female; length about 7 mm.; head and thorax dark green, abdomen dark blue; sides of face with long white hair; antennae long and slender, dark; tegulae steel-blue anteriorly, posteriorly dark reddish; tarsi slender, hind basitarsi with an angulation beneath beyond the middle; sixth segment of abdomen only very feebly submarginate in middle, seventh strongly bidentate; stipites apically rounded, simple, shaped like the last joint of a finger. *O. rohweri* was described as a variety of *O. hypochrysea* Ckll., but it always has the first recurrent nervure about twice as far from base of second submarginal cell as second from apex; whereas in *hypochrysea* the recurrents are about equally far from base and apex.

Colletes nigrifrons Titus.

Early last summer Dr. Lutz and Mrs. Cockerell noticed at Boulder that *Mertensia* flowers frequently had a large hole in the tube, evidently cut by some bee to get at the nectar. In spite of a good deal of effort the culprit remained unknown until in July we were camped in the Roan Mountains, at the head of the Ute trail. There I was so fortunate as to catch the bees in the act, and they were *Colletes nigrifrons.* This is a short-tongued bee, which could not get at the nectar in a legitimate manner.

Andrena micranthophila Ckll.

A new locality is Ute Creek, Colo. (Sage Flats), July (L. Bruner).

There are at present (Jan. 15) 612 species of bees known from Colorado, and in addition a considerable number of varieties and races.

APPARENTLY UNDESCRIBED CANADIAN ASILIDAE AND DOLICHOPODIDAE, (DIPTERA).*

BY C. HOWARD CURRAN,
Ottawa, Ont.

Holopogon albipilosus n. sp.

Differs from *seniculus* Loew in having decidedly shorter pile throughout.

Length 6.5 to 7 mm. *Female.* Face and front silvery white; wholly white pilose. Occiput shining black; pale pollinose below; pile white. Antennae black, first joint rather slender, longer than the second, which is nearly as broad as long; third equal to the first two combined, as wide as the first, gradually slightly narrowed to the apex, style moderately slender, half as long as third joint. Hair on antennae whitish.

Thorax shining black; a large square spot in front, the sides of the mesonotum and the pleura, white pollinose. No brownish pollen. Pile white, on dorsum erect, straight, moderately abundant, fine; on the pleura woolly. Scutellum shining black, with rather long, slightly woolly pile.

Legs shining black; all the femora rather stout; hind tibiae greatly enlarged; hind tarsi gradually tapering. Pile and bristles of legs wholly whitish. Pubescence on front and hind tibiae and tarsal pads dull yellowish.

Wings pure hyaline. Halteres yellow, the basal half brown.

Abdomen shining black, with pale yellowish or white pile which is longer on the sides, especially basally.

Male. Face and front black pilose; antennae black haired.

Thorax with yellow pollen on mesonotum instead of white, and with some black hairs on disc.

Pile on disc of abdomen black, on sides beyond the third segment yellow.

Holotype—♂, Vernon, B. C., August 5, 1920, (N. L. Cutler), No. 569, in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—2 ♀, Vernon, B. C., July 16 and 21, 1920, (N. L. Cutler); ♀, Chilcotin, B. C., July 17, 1920, (E. R. Buckell).

I had determined this species as *seniculus,* but comparison with the type proves it to be distinct and it is readily recognized by the much shorter pile throughout, especially that on the thorax.

Holopogon tibialis n. sp.

Distinguished from all other species by lacking yellowish pubescence on hind tibiae.

Length 8 mm. *Male.* Face and front shining black, the colour of the former obscured when viewed from above, by whitish yellow pollen; front thinly brownish yellow pollinose, hardly shining. Occiput shining black. Head black pilose except on the occiput below. Antennae black; first joint one and one-half times as long as second, second twice as long as wide; third as long as first two, slightly coarctate sub-basally; style half as long as third joint, very slender.

Thorax shining black, thinly tawny pollinose, with a broad, more blackish

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept., of Agric., Ottawa.

stripe on either side of the middle line. Pile black, yellow on pleura; white on humeri and propleura. Scutellum black, with long black pile.

Legs shining black; black haired; basal half of femora and front four tibiae white haired; all the bristles black. Pubescence on front tibiae and tarsi, yellow, on the hind ones, brown. Hind tibiae greatly enlarged.

Wings tinged with brown. Halteres yellow, their base brown. Abdomen shining blue black, with a violet cast; black pilose, except on sides of first three segments.

Holotype— ♂, Jordan, Ont., June 28, 1919, (Curran), No. 570, in the Canadian National Collection, Ottawa.

Paratype— ♂, June 29, 1919, same data.

Nicocles canadensis n. sp.

Differs from other species by having only the last abdominal segment in the male silvery.

Length, 9 to 14 mm. *Male.* Head black in ground color, but almost concealed beneath dense white pollen, the occiput with some yellowish brown pollen above. Face gently concave; almost flat; with some scattered, fine white hairs, mystax rather fine, long, white, no bristles. Front bare except a few hairs opposite the ocellar tubercle and some longer ones on it, the bristly hairs yellowish. Occiput with white hairs, the bristles which are short and moderately stout, yellowish. Antennae black, with a slight whitish sheen in some lights, the first two joints with yellow hairs; first joint longer than second; third joint one and one third times as long as the first two combined, its upper surface almost straight, its lower very slightly convex; arista equal to the first two joints, moderately slender.

Thorax shining black in ground colour, the broad sides of the mesonotum and pleura greyish white pollinose; and there is a similar coloured median stripe on the anterior half of the former. On either side of the median line the colour is deep black, and becomes tawny brownish before the lateral white margin, the brown expanding posteriorly to form a broad band before the scutellum, so that the black is well separated from the posterior margin. The scattered hairs on the dorsum are whitish, the bristles reddish; propleura with fine, the epipleura with stout white hairs. Scutellum with the ground color concealed by white pollen, the apex and a narrow transverse median line with a yellow tinge in some lights; with a few long, scattered white hairs, and four reddish bristles.

Coxae black, densely greyish white pollinose, with fine white hairs. Front femora black, their apices, broadly below, and a small ventral basal spot, reddish; hind femora reddish with a broad black stripe in front. Tibiae reddish, the hind ones darkened on the basal half externally. Tarsi black, the joints narrowly reddish basally; the basitarsi and hind tarsal joints broadly reddish basally. Hair on legs not abundant, short, whitish; on the posterior and ventral surfaces of the front four tibiae, long, white; middle tibiae with row of white bristles on antero-outer surface; hind ones with a row of short, widely set white bristles on front and hind outer surfaces. Each tarsal joint with two apical, fine yellow bristles. Hind femora a little thickened and curved down-

ward apically; hind tibiae swollen on apical fifth, their tarsi largest at end of first joint, thence gradually narrowing.

Wings hyaline, with clouds on all the crossveins and furcations, a long dash behind the stigma and the apex of the wing broadly brownish. Halteres fuscous.

Abdomen steel blue, the sides of each segment with a sericeous stripe, wider in front, narrow behind, rising almost or quite at the base of the segment and reaching its apex. Second segment with a brown pollinose spot in front, the sides of the first segment with more or less brown pollen. The last segment is red, with a broad, black, more or less triangular basal black spot and triangles on the lateral margin reaching quite to the apex, black; the whole segment silvery from front view. Pile of abdomen, short, appressed, yellowish; white and erect on sides. Venter tawny with black spots, a pair of basal spots and the sides of each ventral segment grey.

Female. Third antennal joint slightly longer, with almost parallel sides.

Wings with the markings darker, and with the veins bordered with brown at the apex of the wing, instead of with a continuous cloud.

Abdomen with the grey pollen produced inwardly as a triangle on each segment, on the fifth and sixth segments forming large triangles, on the seventh a smaller triangle. The venter is scarcely tawny, being more greyish, the spots larger.

Holotype—♂, Saanich, B. C., April 19, 1914, (W. Downes), No. 568, in the Canadian National Collection.

Allotype—♀, Seattle, Washington, June 4.

Paratypes—♂, Royal Oak, B. C., May 26, 1917, (R. C. Treherne); ♂, Mt. Douglas, B. C., April 19, 1918, (W. Downes); ♂ Seattle, Washington, April 12.

A second female has hind legs black, with only traces of red on femora and tibiae. It may be distinct.

Syntormon tricoloripes n. sp.

Femora green, becoming blackish, their apices, except the hind ones, reddish; tibiae and front four basitarsi reddish; tarsi black. Front moderately shining purple.

Length 5 mm. *Male.* Face whitish, a little more silvery coloured above, narrowest in the middle. Palpi brown, their apices with pale yellow pollen; with fine white hair. Front metallic purple, depressed, the narrow sides green. Antennae black, with black hair; third joint with tawny pubescence; first joint sub-triangular, the inner apex sharp; second slightly longer than the first, its projection long and narrow; third joint large, subtriangular, the lower border flattened as far as the tip of the second joint, its apex acute; arista not quite terminal, rather slender, tapering, the basal section about four times as long as wide, bare. Occiput metallic green with a triangular bronze spot below the vertex, wholly thinly white pollinose. Orbital ciliæ black; hair on lower half whitish, rather fine. Lower orbitals wanting.

Thorax metallic green; mesonotum with a narrow cupreous brown median stripe, a broad, irregular cupreous stripe on either side; more or less irregularly

cupreous laterally and the mesopleura wholly so. Thoracic bristles black; short bristly hairs limited to the median line and an angle in front; there is a double row of tiny bristles on either side of the middle line which reaches to the first large bristle, then extends across to the side behind the humeri. Epipleura and propleura with white pile.

Coxae green, yellowish at apices, thinly whitish pollinose, clothed with fine white pile; one large black bristle on outer surface of hind coxae. Femora metallic green, the apices of the front four broadly, of the hind ones narrowly, reddish yellow, the colour blackish just before the yellow ground; tibiae reddish tarsi black, the front four basitarsi reddish except their apices; pile wholly black. Middle femora with a row of black bristles on a little more than the median half below, middle and hind femora each with one preapical bristle. Hind tibiae gradually thickened on apical half.

Wings tinged with brownish, especially marked anteriorly. A darker spot on the crossvein and at the curve of the fourth vein. Costa a little thickened beyond the first vein. Squamae with a slight yellow tinge, with a brown border, the fringe yellowish white. Halteres yellowish white.

Abdomen metallic green, thinly covered with greyish pollen, the base of the segments cupreous, more broadly so in the middle, this color occupying about half the segment on the apical three. Hairs black, with some shorter, finer whitish intermixed, these hairs more abundant and longer laterally. Genitalia small, black.

Female: Face wide, yellowish pollinose; middle and hind femora reddish, the latter with a black spot before the preapical bristle; posterior basitarsi reddish on basal third.

Holotype— ♂, Cranbrook, B. C., May 12, 1922, (C. B. D. Garrett), No. 566, in the Canadian National Collection.

Allotype— ♀, same data, May 18th.

Paratypes— ♂; same locality, May 12, ♀ May 5, (Garrett).

Readily distinguished from *affinis* Wheeler, by the dark legs.

Porphyrops grandis n. sp.

Large, 7.5 mm.; thorax bright green or blue green; middle and hind coxae with terminal matted tuft of black hairs; ciliae of squamae and halteres yellow; legs chiefly yellowish.

Length 7.5 mm. *Male*. Face very narrow; narrowest about the lower two-thirds; shining yellowish white; brown just below each antenna. Front bright green, the sides and ocellar tubercle deep blue or blackish; bare except for the black bristles. Occiput green; superior bristles black; hairs on lower half white, abundant. Antennae black; third joint enlongate oval-triangular, its apex sharply rounded; arista terminal, its first joint twice as long as wide, rather stout. Eyes brown pilose, the posterior orbits with pale pile. Palpi black, yellow pollinose anteriorly, black haired.

Thorax brassy green, sometimes bluish on the disk, with a wide geminate, slightly darker median line, scarcely pollinose; pleura thinly greyish white pollinose. Bristles black; propleura with rather abundant milky white hair. Scutellum concolorous with disk of thorax, with three of four bristles laterally, the inner one much the strongest.

Legs: coxae blackish, rather thickly greyish pollinose; all rather abundantly milky white pilose; the front four with a long, black, stout hair on the outer surface sub-apically, the middle ones with a long apical pencil of black hairs, the hind ones with a much shorter apical pencil, no external bristle. Front femora metallic green, the narrow base and broader apex, reddish yellow; middle and hind femora reddish yellow, the former with a metallic green stripe on the inferior basal half, the latter with a ventral black stripe. Femora black haired, the front four white haired beneath, the middle ones with long hair beneath; front femora with rather long, moderately abundant black hair on posterior surface, stouter apically; the middle and hind each with five to eight strong black bristles behind and three or four in front, apically. Hind femora black above at apex. Tibiae yellowish, the hind ones black on inner surface, their apex darkened, all with two rows of black bristles outwardly, the middle ones with two bristles on apical fourth beneath, one anterior, one posterior. Tarsi black, the front four basitarsi wholly pale, the front one swollen at apex, the second joint rising at its top.

Wings hyaline, yellowish anteriorly and along the veins; anal cell rounded apically. Third vein curved backward apically, the fourth vein curved forward beyond the middle of its last section, then curved back apically to end in the tip of the wing. Costa simple. Allulae small with long fringe of white hairs. Squamae pallidly yellowish, with long yellowish white ciliae. Halteres yellow, their basal half pale brownish, finely whitish pubescent.

Abdomen metallic green, with brassy reflections; first segment and narrow bases of the remainder, broadened medianly, blackish, rather dull, bordered with bronze. Hairs sparse, black; first three segments with long pale yellow hairs laterally. Sixth segment bright blue. (What I have termed the first segment in describing the color is not usually counted and I have not counted it otherwise.) Genitalia black, the bulb more or less greenish. Lamellae moderately broad sub-basally, as long as last two abdominal segments, dirty yellowish, its apical fourth brown, hair black. Claspers black, shining, flattened, with subparallel sides, the end a little curved downwards so as to appear clubbed from lateral view; from same view they are very thin. Sides of abdomen thinly white pollinose.

Holotype—♂, Agassiz, B. C., July 24, 1922, (R. Glendenning). No. 579, in the Canadian National Collection.

Paratype—♂, same locality and collector, May 11, 1922.

NOTES ON ABERRATIONAL NAMES OMITTED FROM THE BARNES AND McDUNNOUGH CHECK LIST (LEPID.)

BY WM. BARNES and F. H. BENJAMIN,
Decatur, Ill.

In Can. Ent., LIV, 100, Dr. McDunnough called attention to names which Dr. Strand applied to aberrations of Catocala listed by Sir George Hampson in Cat. Lep. Phal. B. M.

Letters to Dr. Strand disclosed the fact that practically all of the unnamed "aberrations" of Hampson's Catalogue have received names. This means that a large number of names have been omitted from the Check List and complicates the synonymy of the Phalaenidae (Noctuidae). In a number of cases these names will be found applicable to species and forms named by Dr. Smith and other

workers in publications usually having priority. A few have been named subsequently. Others, due to misidentifications by Hampson, will refer to older names the types of which were unknown at the British Museum at the time of the publication of the various volumes of the Cat. Lep. Phal. Still others apply to forms or aberrations placed in the synonymy because various revisional workers and cataloguers have not considered them distinct enough to be worthy of separate names. In groups where species closely resemble one another, such as *Polia, Eriopyga, Autographa, Catocala*, etc., the actual application of many of Dr. Strand's names will be doubtful until the specimens from which Hampson drew his diagnoses of "ab. 1," "ab. 2," etc. can be studied; and the naming of further species or forms in the more difficult groups entails a considerable risk of creating synonyms. It is still an open question if a name can be elevated to specific rank which was originally described as an aberration; but pending advice from Dr. Stiles, Secretary of the International Commission of Zoological Nomenclature, the authors follow the usual custom of considering a name available regardless of the status given it by its author.

Inquiries have already gone forward to the authorities of the British Museum in regard to the fixation of a definite specimen as the "type" of each of Hampson's "aberrations," the same specimen becoming the type of the Strand name. It is hoped that with the assistance of Mr. Tams most of Dr. Strand's names can be fitted to actual types and thus placed.

An example of a considerable number of names omitted from the Check List is to be found in the genus *Autographa*. Because of an ever increasing number of new species and forms being named in this genus it will, perhaps, be well to re-publish the names applied by Dr. Strand which deal with the fauna of Boreal America. These names were published in the Archiv fur Naturgeschichte, 1916, A, 2, pp. 47-50.

Autographa microgamma ab. *v-notata* Strand.

It is likely that true *microgamma* does not occur in North America, in which case ab. *v-notata* need not be added to the lists. Should the European species be found distinct from its American representative, the name *montana* Packard (1874, Guide to the Study of Insects, p. 313, *Plusia*), also omitted from all lists, will probably be found to apply to the North American form.

Autographa lula Strand.

1913, Hamp., Cat. Lep. Phal. B. M., XIII, 419, *snowi* ab. 1, *Syngrapha*.
1916, Strand, Archiv. für Naturgesch., A. 2. 47. *snowi* ab., *Syngrapha*.
1913, Hamp., Cat. Lep. Phal. B. M. XIII, 418, pl. CCXXXVI, f. 8, (as "snovi"), *Syngrapha*.
1919, Ottol., Jour N. Y. Ent. Soc., XXVII, 121, pl. XV, f. 2, *Autographa*.
1921, McD., Can. Ent., LIII, 85, *diasema* race, *Syngrapha*.
1922, McD., Can. Ent., LIV, 139, an sp. dist., *Autographa*.

The name *lula* Strand apparently has priority for the species. It is based on ab. 1 of *snowi* Hampson (nec. *snowi* Hy. Edw.).

Apparently the normal form is the one figured by Mr. Ottolengui as the type of *diversigna*, and has at least some trace of a spot or dash disconnected with the U-shaped stigma.

Autographa epigaea ab. *epigaeela* Strand (ab. 1 of Hampson).

Autographa rectangula ab. *demaculata* Strand (ab. 2 of Hampson).

Autographa octoscripta ab. *beta* Strand (ab. 3 of Hampson).

Autographa excelsana Strand.

1913, Hamp., Cat. Lep. Phal. B. M., XIII, 427, *excelsa* ab. 1, *Syngrapha.*
1916, Strand, Archiv für Naturgesch., A, 2, 47, *excelsa* ab., *Syngrapha.*
form normal *alta* Ottolengui.
1919, Ottol., Jour. N. Y. Ent. Soc., XXVII, 125, *Autographa.*
homonym *excelsa* Ottolengui.
1902, Ottol., Jour N. Y. Ent. Soc., X, 71, pl. VI, f. 3, *Autographa.*

Mr. Ottolegui sunk his name *excelsa* because of *excelsa* Kretchmar, proposing *alta* in its place, (1919). Unless Hampson's identification of "*excelsa* ab. 1" was erroneous, Strand's name *excelsana* apparently attains specific priority.

Autographa altera ab. *alterana* Strand (ab. 1 of Hampson).

Autographa egena ab. *egenoides* Strand (ab. 1 of Hampson).

Autographa brassicae Riley.

1870, Riley, Second Rept. Ins. Mo., p 110, f. 81, biol., *Plusia.*
synonym *u-notata* Strand.
1913, Hamp. Cat. Lep. Phal. B. M., XIII, 468, *brassicae* ab. 1, *Phytometra.*
form *echinocystidis* Strecker.
1874, Stkr., Rhop. & Het., p. 94, *Plusia.*

The name *u-notata* applies to the form of *brassicae* with the U-shaped stigma and spot disconnected. According to Dr. Riley's figure of his type, and a specimen compared with the type in the National Museum, this form is the one to which the name *brassicae* must apply. If it is desired to split upon the character of the stigma the name *echinocystidis* may be used for the form with the stigma and spot connected. Apparently the first description of this form is in Strecker, Lep. Rhop. & Het., p. 94, and although Strecker credited the name to "Behr Mss.," the description was obviously written and published by Strecker so that the authorship will have to be credited to him. The name was originally written *echinocystidis*; and in 1900 Strecker wrote it *echinocystides* (Lep Rhop. & Het., Suppl. 3, p. 33). It is usually written *echinocystis* but in the absence of proof of a *lapsus calami* the original orthography should be preserved.

Autographa putnami ab. *punctistigma* Strand (ab. 1 of Hampson).

Autographa putnami ab. *mendocinensis* Strand (ab. 2 of Hampson).

Possibly represents a distinct species or race.

Autographa biloba ab. *venezuelensis* Strand (ab. 1 of Hampson).

Probably represents a distinct species or race not found in Boreal America.

Autographa oo ab. *oonana* Strand (ab. 1 of Hampson).

Autographa precationis ab. *tana* Strand (ab. 1 of Hampson).

Autographa bimaculata ab. *adapa* Strand (ab. 1 of Hampson).

Autographa pseudogamma ab. *freya* Strand (ab. 1 of Hampson).

Autographa ou ab. *ouana* Strand (ab. 1 of Hampson).

Autographa ou ab. *ouella* Strand (ab. 2 of Hampson).

This name is presumably a straight synonym of *pedalis* Grote, judging from a specimen of ab. *pedalis* compared with type by Dr. McDunnough.

Autographa metallica ab. *kasloensis* Strand. (ab. 1 of Hampson).

Judging from a series in the Barnes Collection the differences between *metallica* and *kasloensis* are mainly due to the age of the specimens. Fresh specimens have the maculation considerably brighter and in general more intensified than old specimens.

NOTES ON LYGAEUS KALMII STAL. AND ALLIES (HEMIP.)[1]

BY E. P. VAN DUZEE,
San Francisco, Calif.

In the April, 1923, number of the Canadian Entomologist Dr. Parshley gives some interesting notes on *Lygaeus kalmii* Stal. It seems to me that he has misidentified this and some allied species, probably through following Stal in the Enumeratio Hemipterorum.

Lygaeus turcicus Fabr. is a Mexican form which spreads well over our southern states and may be distinguished by the Y-shaped red mark on the head, the red base of the clavus and the almost immaculate membrane.

Lygaeus costalis H. S., with a still more southerly distribution, has the red on the head reduced to a basal spot, the red more extended on the clavus and the membrane white-margined.

Lygaeus reclivatus Say has the red basal spot on the head as in *costalis* but the clavus is black and the membrane heavily marked with white. This is the *kalmii* of Dr. Parshley's paper and, as he says, is western in distribution. It is abundant in California and is the only species of this series I have taken here. It includes varieties *a* and *b* of Stal's *Kalmii*.

Lygaeus kalmii Stal differs from *reclivatus* in having the white membranal margin very narrow and the discal spot wanting or very small. This is variety *c* of Stal's *kalmii* and it is *angustomarginatus* Parshley. It might be better to sink Stal's name *kalmii* as a straight synonym of *reclivatus* and use *angustomarginatus* for the eastern form, but Stal's description of *kalmii* covers both forms and the name has been used for our eastern species for so many years I would personally favor retaining it, an entirely permissible procedure, as Stal does not indicate which of his three varieties he considers typical. The variety *cnotus* Say should perhaps replace *kalmii*, but Say says "Mexico" and I doubt if the eastern form extends so far south. Montandon's melanic *melanodermus* is unknown to me.

SOME NEW NOCTUIDS FROM BRITISH COLUMBIA (LEPID.)

BY E. H. BLACKMORE,
Victoria, B. C.

AGROTINAE

Euxoa lindseyi nov sp.

Palpi white exteriorly with a cluster of black and fuscous scales near the distal end of the second joint. Head and thorax pale ash grey with a few black scales at the tips of the patagia. Abdomen concolorous with thorax, with tufts of long white hair at base.

♂. Primaries cinereous grey sparsely scattered over with fuscous scales Basal line dark fuscous, indicated on costa, re-appearing on median vein from which it runs inwardly oblique to vein 2; t.a. line dark fuscous, indeterminate, indicated by spot on costa, a short outwardly oblique dash on radius, another similar on median vein faintly continued in an outwardly oblique direction to vein 2, where it forms a distinct tooth from that vein to inner margin. Reniform and orbicular dark fuscous, illy defined, the former roughly lunate, the latter more or less round. Above the reniform is a dark costal spot. T.p. line punctu-

1—Contributions from the California Academy of Sciences, No. 224.

form, outwardly rounded opposite cell, then slightly inwardly oblique to inner margin. Terminal line dark fuscous broken into intervenular triangular dots. Fringe light fuscous, paler basally.

Secondaries sordid white, terminal line fuscous, with veins outlined in same colour, a few scattered fuscous scales on outer margin. Beneath, primaries pale cinereous with cell darker, t.p. line and reniform showing through dark and distinct; secondaries lighter with small fuscous discal dot, post median band faintly indicated, more prominent on costal portion.

♀. Upper side of primaries somewhat darker caused by the greater number of fuscous scales scattered over the surface, the lines and spots are also a little heavier. Secondaries light fuscous, paler basally. Beneath similar to male.

Alar expanse ♂ 33 mm., ♀ 37 mm.

Described from 7 specimens, 3 males and 2 females taken by the author on Vancouver Island and a male and female from the Barnes collection taken at Calgary, Alta., and Victoria, B.C., respectively.

Holotype—♂, Goldstream, B. C., Aug. 20th, 1920, in Canadian National Collection, Ottawa.

Allotype—♀, Victoria, B. C., Aug. 18th, 1921, in author's collection.

Paratypes—2 ♂♂, Goldstream, B. C., Sept. 11th & 12th, 1920 and 1 ♀ (without abdomen) Victoria, B. C., Aug. 19th, 1916, in author's collection; 1 ♂, labelled Ft. Calgary, N. W. Brit. Col. (Calgary, Alta.) Aug. 20th, 1909, and 1 ♀, (without abdomen) Victoria, B. C., without date, in collection of Dr. W. Barnes.

Superficially this new species is very much like *catenula* Grt., to which it closely allied.

I take pleasure in naming this species after Dr. A. W. Lindsey, to whom I am very much indebted for kindly help on many occasions.

CUCULLIINAE

Onococnemis parvanigra nov. sp.

Palpi deep cream, second joint with a few scattered black scales exteriorly. The second and third joints are clothed posteriorly with long black and white hairs, the black predominating. Head and thorax mouse gray with a somewhat hoary appearance, caused by the gray scales being tipped with white. Abdomen light fuscous, thinly scaled. Primaries, the general effect is brownish black with a somewhat lighter basal area and an irregular diffuse cream colored post-median band. Basal line black, outwardly oblique to sub-costal vein, where it disappears and is indicated again below median vein by two or three black scales. T.a. line brownish black, irregularly sinuous, inwardly oblique from vein 4 to vein 2 and thence outwardly oblique to inner margin. A small patch of ochreous scales precedes the t.a. line between costa and sub-costal vein. Orbicular round, black-ringed, and containing a few light brown and ochreous scales. Reniform sub-lunate, filled mostly with deep cream with some dark brown scales intermixed. Claviform distinct, outlined in black and filled with light brown. Median band brownish black, lighter costally. T. p. line brownish black, beginning a little over one-half out, straight from costa to sub-costal vein, then broadly outcurved to include reniform, then gently incurved to vein 2, from which it runs

obliquely inward to inner margin. This line is edged posteriorly with deep cream scales, which on the lower half of the wing are extended into the s.t. space. Beyond this, on costa, are two small patches of cream scales equidistant between reniform and s. t. line. The s. t. line is faintly indicated by cream scales, which appear at irregular intervals, becoming continuous at vein 4, where it curves to the outer angle of wing. Terminal space brownish black. Fringes concolorous. Secondaries, a broad brownish black band occupies the outer third of the wing; the basal area is dark fuscous and is separated from the broad marginal border by a narrow, somewhat diffuse, cream colored band. Discal dot large, linear, brownish black. Fringes white. Beneath, primaries basal half fuscous, followed by a whitish band from costa to inner margin, which in turn is bordered by a wide brownish black band on outer margin. Secondaries similar to primaries with the addition of a very distinct discal dot.

Alar expanse 25-26 mm.

Described from 4 specimens, one male and three females taken at Kaslo, B. C., and Mt. McLean, near Lillooet, B. C.

Holotype—♂, Kaslo, B. C., (J. W. Cockle) August 10th, 1922, in the Canadian National Collection.

Allotype—♀, Kaslo, B. C., (Cockle) August 6th, 1921, in the author's collection by the kind permission of the collector.

Paratypes—1 ♀, Kaslo, B. C., (Cockle) August 12th, 1909, in the Canadian National Collection. 1 ♀, Mt. McLean, B. C., (A. W. Hanham) August 14th, 1921, in the collection of Mr. Hanham.

Mr. Hanham captured his single specimen at an altitude of 5,500 ft. This new species is very close to *tenuifascia* Sm. but can be distinguished from the latter by its somewhat larger size, its darker ground color, and more contrasted maculation. It is also easily separated by the underside, which in *tenuifascia* is of a uniform warm brown color with a narrow cream band crossing both wings.

Litholomia napaea umbrifasciata nov. var.

This new race is probably best described by comparison with typical *napaea*, which is so well known and has such a wide distribution.

In *napaea* the ground colour is dark grey with the maculation somewhat obscured; in *umbrifasciata* the ground colour is greyish white with a narrow dark brown median band standing out in striking contrast to the remainder of wing. This band divides the orbicular and reniform and runs from costa to inner margin. It is sharply defined on the anterior edge but posteriorly it fades into a paler umber-brown shade extending the whole width of the wing. In some specimens this shade extends to and is bordered by the t.p. line, which gives it the appearance of a rather wide band. The dark-filled reniform, in most specimens, stands out in contrast to the pale ground colour, while the orbicular is sometimes hardly discernible owing to its white filling. In *napaea* the reverse is the case. *Umbrifasciata* also seems a little more robust, a trifle wider in breadth of wing, and somewhat larger, averaging 1 to 2 mm. more in alar expanse than *napaea*.

Described from 15 specimens, 6 ♂♂ and 9 ♀♀ all taken by the author at Victoria, B. C.

Holotype—♂, Victoria, B. C., March 30th, 1916, in the Canadian National Collection.

Allotype—♀, Victoria, B. C., March 21st, 1915, in the author's collection.

Paratypes—5 ♂♂, March 24th to April 10th; 8 ♀♀, March 20th to April 16th.

Paratypes will be distributed to the Canadian National Collection; Provincial Museum, Victoria, B. C.; United States National Museum; and the Dr. Wm. Barnes collection.

This is a very distinct geographical race and occurs throughout the southern half of Vancouver Island. I have also seen specimens from Vancouver, New Westminster, and Fraser Mills. These localities are situated in the extreme western end of the Lower Fraser Valley, which has a similar fauna to that of Vancouver Island.

Typical *napaea* also occurs at various points in the interior of British Columbia, specific localities being Lillooet, Vernon, Salmon Arm, Vavenby and Kaslo.

LEPERISINUS CALIFORNICUS SW. KILLING ASH TREES.

BY R. W. DOANE,

Stanford University, Calif.

For several years we have seen the ash trees (*Fraxinus americanus*) planted on the University campus, suffering from the attacks of a *Leperisinus*. At first it seemed that they might confine their work to the smaller branches, many of which were killed, but during the last two or three years they have been attacking larger branches on many of the trees and they are now often found in the trunk of some of the smaller trees. Practically all of the young trees bordering a road on one part of the campus have been killed in this way, and the older, larger trees, in some parts of the arboretum, are ragged and deformed on account of the loss of so many of the branches.

The primary injury is done by the adult beetle which usually selects some rough place on the bark or at the base of a twig or on a bud as a point of entrance. It then bores into the cambium and begins to bore round the branch or twig, frequently entirely girdling it. The eggs are laid in little niches on each side of the burrow made by the beetle, and the larvae when they issue follow the grain of the wood, working in the cambium and scoring both the bark and the wood. The pupal chambers at the end of the larval burrows are cut rather deeply into the wood.

As we were unable to identify the beetle that was doing this work, specimens were submitted to Dr. J. M. Swaine, chief of the Division of Forest Insects of the Canadian Department of Agriculture, who has determined it as *Leperisinus californicus* Sw., described originally from olive trees, in which it was found to be a primary enemy.*

Most of the species of this genus are not considered to be of primary importance. *L. aculeatus* is very abundant in dying ash throughout the East, but it does not, usually at least, attack the normal trees. There can be no doubt, however, but that the species, referred to in this note, attacks the green limbs of the ash trees, and after killing many of them and thus weakening the tree, it will attack and destroy the cambium of the trunk also.

*—Canadian Entomologist, Vol. 48, June, 1916, p. 190.

A ROOT WEEVIL (STEPHANOCLEONUS PLUMBEUS LEC.) REARED FROM STRAWBERRY

BY S. MARCOVITCH,

Knoxville, Tenn.

Large legless larvae of the weevil type were found beneath strawberry roots at Knoxville on June 14 and again on July 13. A few of the larvae were noticed to be boring into the crown. Since these same larvae were encountered in the soil several times while digging strawberry plants, they evidently feed on the roots also. The larvae were fairly abundant but did not appear to cause any serious injury. Pupae were found in the soil on July 13, 1921, and on July 25 an adult emerged. On December 14, 1921 as well as in March, 1922, larvae in various stages were present. It is probable, therefore, that the insect passes the winter as larva in the soil.

This specimen was sent to Prof. Blatchley, who identified it is *Stephanocleonus plumbeus* Lec. Knoxville is far out of its known range, for hitherto the species has been recorded from New Hampshire, Connecticut, Colorado and New Mexico. As far as the writer is able to learn, its food plant is unknown. It is, therefore, thought worth while to describe a species reared from an economic plant, such as the strawberry.

DESCRIPTION OF ADULT

General coloration greyish; body clothed with a fine whitish pubescence which condenses on the dorsum of the thorax to form two oblique curved bands. Elytra with three black denuded spots on each side; spot near tip of elytra very distinct and shining. Eyes shining black.

Body large, elongate. Beak finely punctured, with a rather high curved median carina, which does not reach the tip of the beak; beak a little shorter than thorax, flat, stout, and somewhat dilated at the tip. Dorsum of head bare, comparatively smooth.

Thorax coarsely punctured, quadrate, suddenly narrowed near apex; sides lobed, partially concealing the eyes; anterior half of thorax with a small median carina, posterior half with a depression. Elytra much wider than thorax, with striae coarsely and closely punctate; intervals flat, finely punctate. Tibiae spined at the tips. Claws of tarsi approximate at base. *Measurements*: Length, 10 mm., width, 4 mm.

LARVA

General coloration whitish; head brownish. Mandibles brownish, darker towards the tip. Maxillary and labial palpi pale yellow. Epicranial and frontal sutures light colored. Eye spot at base of frontal sutures dark. Body hairs brownish.

Body cylindrical and curved toward ventral side. Surface of body wrinkled, with a depressed lateral line visible from the second thoracic to the eighth abdominal segment. Head about as broad as long; antennae very small, one jointed, and situated at base of mandibles. Mandibles unidentate. Legs wanting, but represented by fleshy protuberances, each bearing a cluster of bristles. Body of larva covered with short, sparse hairs. *Measurements*: Length, 9—10 mm., width, 3½—4½ mm.

THE PLEURAL SCLERITES OF DIPTERA

BY RAYMOND C. SHANNON,

Bureau of Entomology, Washington, D. C.

This communication is primarily an attempt to bring some of the results of Dr. B. P. Young's work "Attachment of the Abdomen to the Thorax in Diptera"[1] into more general use by dipterists. In this publication figures of the pleura and the base of the abdomen of at least one species of nearly all of our North American families of Diptera are given. Such a work offers a very convenient means of making comparative studies of this part of the anatomy throughout the entire order besides bringing out a number of very important characters, apparently of fundamental value, which may be used as primary or supplementary characters in our present scheme of classification of families and genera. The sclerites are practically unused in systematic work on Diptera except to indicate the position of scales, hairs, or bristles. Doubtless the study of other species, aided by Dr. Young's work, will bring out additional characters. The writer, during some recent studies on several families of Diptera has made use of Young's paper to good advantage and wishes to further emphasize some of the differences that exist.

The anepisternum (mesopleura) of the mesothorax is divided in all but some of the more primitive species. In the Nematocera the sternopleura tends to have its upper posterior corner fused with the posterior section of the anepisternum and is continued lobe-like to the base of the wing with the pteropleura lying beside it. (See figure of *Anopheles*, ibid, pl. xii, 10). On the other hand the Cyclorrhapha instead of having its upper posterior corner fused and produced has its upper anterior corner somewhat fused with the anterior section of the anepisternum and is produced lobe-like to the fore coxa, and the pteropleura lies dorsad and somewhat caudad of its upper margin. Young, in his brief summary, brings out what practically amounts to the same thing, i. e., as a general rule the pleural suture extends from the coxa to the wing base in the Nemocera; while in the Brachycera generally, and the Cyclorrhapha, this suture takes an abrupt turn cephalad in its course from the leg to the wing base.

The writer wishes to call attention to the episternum of the prothorax, commonly called propleura. It is quite apparent that this structure is composed of two, more or less, fused sclerites. The suture can be traced fairly well in a number of widely separated families and, moreover, the vestiture on the two parts is usually distinctly different. Frequently the lower part is more or less setose and the upper is nude; or the lower part may bear distinct bristles while the upper is merely pilose. It has been found convenient to consider these as two separate structures in taxonomic work and the terms upper propleura and lower propleura are used; or to follow morphologists, they may be called anepisternum and katepisternum respectively.

Both Young and the writer[2] called attention to a chitinous tongue-like structure extending from the latero-caudal side of the meso-coxa across the membrane of the coxa in the Syrphidae about the same time. Young further noted that this was also characteristic of the other families of Cyclorrhapha

*—Published by permission of Chief of Bureau.
1—Cornell Univ. Agr. Exp. Sta. Memoir. 44, 1921.
2—Bull. Brook. Ent. Soc. XVI, p. 67, 1921.

except *Platypezidae, Pipunculidae* and *Conopidae*. The writer wishes to call attention to its absence in *Pyrgota* (*Ortalidae*). He has long thought that the *Conopinae* and *Pyrgota* had much in common and this adds to his belief that both may be more closely related than is commonly supposed.

Additional characters furnished by the thoracic sclerites will be pointed out in forthcoming papers.

AN AMENDED SYNOPSIS OF THE GENUS MYDAEA (DIPTERA, ANTHOMYIIDAE)

BY J. R. MALLOCH,
Washington, D. C.

In the number of the Canadian Entomologist for January, 1921, page 9, I published a synopsis of the genus *Mydaea* Robineau-Desvoidy which does not include all the then described species, and to enable students of the group to identify such forms as are known to occur in North America, I now present the appended key. This key will, I believe, be found applicable to both sexes

KEY TO SPECIES.

1. Legs largely or entirely black, only the tibiae sometimes brownish 2
   Legs with all the tibiae and at least part of the femora yellowish 5
2. Halteres yellow 3
   Knobs of halteres brown or black 4
3. Eyes densely hairy; basal abdominal sternite bare .... *calvicrura* Coquillett
   Eyes bare; basal abdominal sternite hairy ..... *hirtiventris* Malloch
4. Arista with its longest hairs as long as width of third antennal segment; tibiae brownish; wings not yellow at bases ..... *obscura* Stein
   Arista with its longest hairs not longer than its basal diameter; tibiae black; wings yellow at bases ..... *rugia* Walker
5. Scutellum largely or entirely yellowish, contrasting sharply wtih the dark colour of mesonotum 6
   Scutellum black, concolorous with mesonotum 9
6. Palpi yellow; antennae entirely or almost entirely yellow 7
   Palpi black; antennae entirely or almost entirely black 8
7. Sides of scutellum below level of the bristles entirely bare; third antennal segment brownish apically ..... *flavidipalpis* sp. n.
   Sides of scutellum with a few setulose hairs at bases below the level of the long bristles; third antennal segment yellow ..... *flavicornis* Coquillett
8. Hind femur without bristles on posteroventral surface except at apex, the anteroventral surface with the bristles almost absent on basal half..... ..... *occidentalis* Malloch
   Hind femur with some fine bristles on apical half of posteroventral surface, the anteroventral bristles long and strong to base ..... *pagana* Fabricius
9. Longest hairs on arista not longer than width of third antennal segment, usually shorter; prealar bristle about one-third as long as the one behind it 10
   Longest hairs on arista distinctly longer than width of third antennal segment 11
10. Longest hairs on arista about as long as width of third antennal segment; hind femur in both sexes usually with two or three bristles at middle

on posteroventral surface; second antennal segment yellowish; fore femur in both sexes yellow ..... *brevipilosa* Malloch

Longest hairs on arista distinctly shorter than width of third antennal segment; hind femur in both sexes usually with some bristles on basal half on posteroventral surface; second antennal segment black; fore femur in male darkened ..... *persimilis* Malloch

11. All femora largely fuscous; prealar bristle, minute; wings not yellow at bases ..... *obscura* Stein

At most the fore and mid femora infuscated basally 12

12. Small species, 5.5 to 6.5 mm. in length; thorax and abdomen with distinct but not very dense pruinescence, the former distinctly vittate only in front; prealar bristle minute ..... *winnemana* Malloch

Larger species, 7 to 9 mm. in length; thorax and abdomen with dense yellowish pruinescence, the former with very distinct vittae 13

13. Fore femora yellow in both sexes; apical segment of fore tarsus in male slightly, in female very much broadened; prealar bristle one-third as long as the one behind it ..... *discimana* Malloch

Fore femora in males infuscated basally at least; apical segment of fore tarsus normal in both sexes 14

14. Prealar bristle over half as long as the one behind it ..... *urbana* Meigen

Prealar bristle not over one-third as long as the one behind it ..... *neglectus* Malloch

Mydaea flavidipalpis sp. n.

Male and *female*.—Similar to *flavicornis* Coquillett, the antennae, palpi, and legs including tarsi yellow. Differs in having the fore coxae yellow, not brown or fuscous, the yellow colour on humeral and posterior angles of mesonotum more diffused, the fore tibia in female with a median posterior bristle. the pruinescence of abdomen more yellowish, and as stated in key

Length, 7—8 mm.

Type, male, allotype, and three female paratypes, Glen Echo, Md., June 11—August 8, 1921-22 (J. R. Malloch); one male, Plummer's Island, Md. May 23, 1907 (A. K. Fisher).

Mydaea discimana Malloch

Dr. J. M. Aldrich has shown me a female of this species from continental Europe.

AN UNDESCRIBED ANTHOMYID IN THE CANADIAN NATIONAL COLLECTION (DIPTERA)*

BY H. L. SEAMANS,

Lethbridge, Alta.

Pegomyia polygoni new species

Male. Black shining with dense gray pruinescence on the thorax and abdomen. Head reddish with bright silvery pruinescence on the orbits, parafacials, cheeks and whole face except the inner slopes of facial ridges and

*—Contribution from the Division of Field Crop and Garden Insects, Entomological Branch, Dept. of Agric., Ottawa.

upper half of antennal fovae in most lights. Eyes separated by less than the width of the anterior ocellus. The second joint of the antennae reddish, the third twice the length of the second, black, flattened, with a black, very shortly pubescent arista. Vibrissa separated by more than twice the distance between either and the eye margin. Palpi deep black, extreme base yellowish.

Thorax distinctly vittate; presutural acrosticals indistinct; prealar bristle less than half the length of the one succeeding. Wings clear, veins at the base bright yellow, darker only near the tips. Calypteres equal, yellow; halteres yellow. All coxae infuscated; femora and tibiae yellow; tarsi black. Abdomen depressed, flattened, the middle line slightly raised, with an indistinct dorsocentral vitta, and dark markings at the segmental borders, from posterior view. Hypopygium not prominent, basal segment reddish, fifth sternite gray, no remarkable bristling, and only a few bristly hairs on the basal segment.

Fore femora with a row of hair-like bristles on both the anterodorsal and anteroventral surfaces; fore tibiae with one posteroventral bristle near the middle, and with one dorsal bristle at the apical third. Mid femora with a row of four or five small bristles on the apical fourth of the posteroventral surface, and two short, postero-apical bristles; mid tibiae with three or four posterior and one postero-dorsal bristle. Hind femora with a row of seven or eight antero-ventral bristles and an irregular row of antero-dorsal bristle-like hairs; two dorsal preapical bristles, a preapical posterior bristle and a row of three or four closely placed, short postero-ventral bristles close to the apex; hind tibiae with two short antero-ventral, two strong antero-dorsal and three postero-dorsal bristles. Length 5-6 mm.

Female. Differs from the male in its smaller size, general yellowish gray color, especially marked on the scutellum and abdomen, rather thickly greyish yellow pruinose, the pollen shining.

Head generally more yellowish than red, with dense silvery pruinescence as in the male. Lower supra orbital bristles directed backward, upper orbitals directed forward and divergent. No thoracic or abdominal markings, but mesonotum and pectus diffusely somewhat darker. Bristling of the legs much the same as in the male except that there are four antero-dorsal and two postero-dorsal bristles, with an additional antero-dorsal and postero-dorsal apical bristle, much smaller than the others. Length, 4.5—5 mm.

Holotype— ♂, Aweme, Man., May 25, 1921, (N. Criddle); bred from *Polygonum convolvulus* L.; No. 592, in the Canadian National Collection, Ottawa.

Allotype— ♀, same data, May 24.

Paratypes—2 ♂, same data, May 24, and 25, the latter headless.

This species was reared by Mr. N. Criddle of the Entomological Branch, at Aweme, Manitoba. The larvae were found mining in the leaves of *Polygonum convolvulus* L. during September. Mr. Criddle states that the mines were a blotch mine forming a rather large blister. The larvae pupate in the fall and the adults emerge the following May. It is probable that there is more than one brood during the year.

This species runs to *unguiculata* Mall. in Malloch's key to the genus *Pegomyia* as published in the "Bull. Brook. Ent. Soc.," Vol. XV, p. 121, but is readily distinguished from that species.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The sixtieth anniversary of the founding of the Entomological Society of Ontario will be celebrated by a series of meetings to be held in Ottawa on Thursday, Friday and Saturday, November 1st, 2nd and 3rd, 1923.

It is to be hoped that all members and friends of the Society will make a special effort to attend and participate in the programme. Titles of papers should be in the hands of the local secretary not later than Monday, October 22nd.

Reservations may be obtained at the Chateau Laurier, Russell, Alexandria and Windsor Hotels. Members are advised to make their reservations early.

FRANK MORRIS, President,
A. W. BAKER, Secretary.

LEONARD S. McLAINE,
Local Secretary,
Entomological Branch,
Dept. of Agriculture, Ottawa.

Date of mailing, September 29th.

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A CURIOUS PHASE OF PARASITISM AMONG THE PARASITIC HYMENOPTERA

BY L. O. HOWARD,

Washington, D. C.

It has previously been pointed out by the writer and by others that the history of the evolution of parasitism with the Hymenopterous families now composed principally of true parasites can be traced to-day through the different phases which exist at the present time. The beginning of parasitism can be found in the case of certain forms of the subfamily Eurytominae inhabiting Cynipid galls, and there are other species which have acquired the parasitic habit which are catholic in their choice of hosts, others which have become adapted only to host insects living in a certain manner, while others confine themselves in their attacks to certain families; others to the species of certain genera, and others to single species.

In the whole order Hymenoptera, however, it would be difficult to find so advanced a degree of parasitism as occurs with a minute Proctotrypid of the subfamily Scelioninae which parasitizes *Mantis religiosa* in Europe. The Scelioninae for the most part are egg parasites, and the parasitic habit is confined to their larvae, which feed within the eggs of the host insects (mostly Orthoptera) and issue as free-living adults whose short life is spent for the most part in mating and oviposition. The little form in question, which is known as *Rielia manticida* of Kieffer, has a true ecto-parasitic life in its adult stage, and its habits are carefully displayed by L. Chopard in an article on the parasites of the praying Mantis in the "Annals of the Entomological Society of France." Volume 91, pp. 249-272.

The adults of the parasite, which are fully winged, though flying feebly, issue about the end of August and through September at about the period when the praying Mantis becomes adult. Whether they reach the female Mantids by flight or whether they crawl upon them from the twigs of shrubs upon which both occur is in doubt, but probably the latter, in the same way as the triungulins of the blister-beetles crawl upon bees. Having succeeded in grasping one of the Mantids, it becomes from then on a true parasite, living at the expense of its host, and never leaving it until it is time for it to lay its eggs. It soon loses its wings, and in the late autumn all that are found upon the Mantids are wingless. The late Alfred Giard thought that the wings were rubbed off by the movements of the segments of the host, but Chopard says that this cannot be true, since the Rielia wings are cut off at a precise point and in a neat way, so that they appear to have been cut with a pair of scissors. He thinks, therefore, that they fall off in the way that the wings of ants fall off, although at a little distance from the base.

The little parasites are generally found more abundantly upon the females than upon the males of the Mantids, and often more than one parasite is found upon a single host, very often two or three, more rarely four or five, and some-

times six. The Rielias fix themselves under the wing, or under the elytron, upon the sides of the thorax, and not rarely at the end of the abdomen between the anal valves. Where several of them occur upon a single host, they choose locations distant from one another. The Mantid notices the attack of the Rielia by vigorous movements when sensitive points are touched, as the sides of the abdomen. It tries to remove them with its legs, and sometimes it succeeds.

The parasite may live for several months without leaving its host, and undoubtedly takes nourishment from it. Chopard has seen it eating the base of the wing-veins of its host.

The adult Rielia is then a parasite, and one whose fate depends closely upon that of the host which it has attacked, for its destiny is very different when it has attached itself to a male rather than a female. If it happens to attach itself to a male, whose life, normally short, is usually cut *very* short by the fact that it is eaten up by the female in the act of coupling, the life of the Rielia is also very short and ineffective. One would think that it would change from male to female during the act of coupling, but this is not done by the parasite. In the same way, in a case where one of the parasites was found upon an immature Mantid, it was not able to change its place with the casting of the skin, and remained fixed upon the exuvium.

The eggs of the Mantid, to the number of one thousand to twelve hundred, are deposited in two or three successive batches in egg-cases formed of a spumy mass which hardens like parchment in the air. These egg-layings are usually made during October and November.

About half an hour before laying her eggs, the abdomen of the Mantid contracts violently, and this is a signal to the parasites to quit their shelter under the wings of the host. They travel slowly along the sides of the abdomen and seek to reach the genital region of the host insect. The Mantid, in fact, seems to feel their presence at the time, but she is so intent upon her egg-laying that she makes only a feeble attempt to brush them off with her legs. However, Chopard has seen the egg-laying interrupted in this attempt, and sometimes the female succeeds in throwing the parasite off, but usually the parasite succeeds in reaching the egg-case which is being formed and which is at first of a viscous nature, and in the middle of this semi-liquid mass continually moved about by the abdomen of the Mantis the Rielia finds itself about to be swallowed up by the sticky stuff, but finally it lays its eggs, probably in the eggs of the Mantid.

The parasite tries to remove the gluey substance from its body and to climb back on its host. Often it fails, and dies. If, on the contrary, it is able to regain the body of the Mantis, it finds its usual place and then tries to remove the accumulation which has dried upon the surface of its body and clogs its legs and its antennae. Sometimes it does not succeed, and Chopard has seen one with one antennae permanently put out of business. Now we see another good reason for its having rid itself of its wings at an earlier stage, for the wings would be hopelessly clogged by the secretion of the Mantis.

The larvae of the Rielia are to be fond in the eggs of the Mantis. Chopard describes the different stages, but has not succeeded in finding the pupa. He thinks, however, without doubt, that pupation occurs in the egg of the Mantis and that it lasts only about fifteen days.

CYPHODERRIS MONSTROSA UHLER IN BRITISH COLUMBIA (ORTHOPTERA)

BY E. R. BUCKELL,
Entomological Branch, Ottawa.

Cyphoderris monstrosa Uhl.

Uhler, Proc. Ent. Soc. Philad., II, p. 552 (1864).
Walker, Cat. Derm. Salt. Brit. Mus. II. p. 248 (1869).
Thomas, Proc. Davenp. Acad. Nat. Sci. I, p. 263 (1876).
Scudder, Can. Ent., XXXI, p. 117, (1899).
Scudder, Cat. Orth. U. S., p. 80 (1900).
Scudder, Can. Ent. XXXIII, pp. 17-19 (1901).
Scudder, Psyche, IX, p. 167, (1901).
Turley, Can. Ent. XXXIII, pp. 246-248 (1901).
Caudell, Ent. News, XV, p. 63 (1904).
Caudell, Jour. N. Y. Ent. Soc., XII. p. 47 (1904).
Ent. Record, Rep. Ont. Ent. Soc. p. 131 (1907).
Buckell, Proc. B. C. Ent. Soc. p. 32, No 18, Systematic Series (1921).
Buckell, Proc. B. C. Ent. Soc. p. 9, No. 20, Systematic Series (1922).

During the past four years the writer has found this insect in many localities in the interior of British Columbia and has been able to assemble some notes on its life history and habits. It has also been possible, from the examination of a long series of specimens, to observe considerable variation in the coloration and roughness of the surface of the pronotum; particularly in that of the male. The original description of this species was made by Uhler from the male in 1864 and it was not until 1901 that the female became known. No descriptions are given in this article, as both generic and specific descriptions have been published by Mr. A. N. Caudell, in the Journal of the New York Entomological Society, p. 47, Vol. XII, 1904. A description of the coloration of the living female is also given in the above publication by Professor Scudder and again on p. 18 of the Canadian Entomologist for 1901.

NOTES ON VARIATIONS

A few specimens of this species have been collected from time to time in British Columbia at elevations ranging from 1,000 to 7,500 feet. Among these there were no marked variations either in the coloration or size of the individuals. On May 26, 1922, the writer collected fifty adult males and thirty adult females at Nicola, B. C., at an elevation of 2,200 feet and it is with regard to this series that the following remarks are made. The series was obtained at night between the hours of nine and twelve by searching with a strong gasoline lantern amongst the bushes of *Amelanchier cusickii, A. florida* and *Elaeagnus argentea,* which were growing close to the Nicola River and on which the insects were feeding. The whole series was collected on about two acres of land, and at this date all stages from small nymphs to adults could be found. These eighty adults were retained in five per cent. chloral hydrate solution until December, when they were all carefully measured and the results tabulated. The measurements of the eighty specimens will not be included here, but will be quoted from to show the variation in measurements which was found in this series.

THE FEMALE

The measurements of a typical large female were: Length to end of cercus, 35.0 mm.; length of pronotum, 8.0 mm.; greatest width of pronotum, 8.5

*—Contribution from the Division of Field Crop and Garden Insects, Entomological Branch, Dept. of Agric., Ottawa.

mm.; tegmina vestigial; length of hind femur, 11.5 mm.; length of hind tibia, 10.5 mm.; length of hind tarsus, 7.5 mm. The small nymphs are very soft and light colored and easily distinguished from the adult. In the last instar a large nymph closely resembles a small adult in general size and coloration, but may readily be separated by the following characters. They are softer and lighter in color and always have the markings on the face and legs a dark brown instead of the rich shining black of the adult. The surest way to decide if the specimen is adult is to examine the ventral surface. In the nymph the coxae, trochanters and sterna are pale clay yellow and any markings that are present are light brown; while in the adult the coxae and trochanters are shining black or a very dark purple, and the sterna are pinkish marked with black, and the whole insect has a harder and more burnished appearance. In the thirty females examined the total length was variable according to the age of the specimen and the presence or absence of eggs within the body cavity. The largest specimen measured: Total length, 35 mm.; length of pronotum, 8.0 mm.; greatest width of pronotum, 8.5 mm.; hind femur, 11.5 mm. The smallest specimen measured: Total length 28.0 mm.; length of pronotum, 6.0 mm.; greatest width of pronotum, 6.0 mm.; hind femur, 8.5 mm. The average measurements for the thirty females were: Total length, 28.866 mm.; length of pronotum, 7.45 mm.; greatest width of pronotum, 7.416 mm.; hind femur, 10.266 mm.

There is no constant color pattern shown in the pronota of the females. In some the ground color is considerably darker than in others and the intensity and distribution of the dark markings is very variable. In all the specimens examined from British Columbia the tegmina and wings are vestigial. It is interesting to note that the specimen described and illustrated by Caudell (Fig. 1, p. 50, Jour. N. Y. Ent. Soc. Vol. XII, 1904) has the tegmina and wings partially developed. It is stated that "the elytra are fairly well developed, nearly black, projecting well beyond the thorax and slightly overlapping; the wings of the same development and shape as the elytra, being about as broad as long and nearly round. Those specimens with minute, widely separated elytra almost hidden beneath the thorax I have considered as nymphs, though some are fully as large as the single undoubted adult before me. These supposedly immature forms differ from the adult in having undeveloped wings and the legs are usually shorter, the posterior femora of even the larger specimens being in some cases scarcely more than 8.0 mm. in length. It is possible that this species is in the midst of the evolutionary process of becoming apterous, as indicated by the aborted underwings of the male. In this case the female with more fully developed wings may be a case of reversion to the ancestral type, in which case the supposedly immature forms may really be adults." There is no doubt that the thirty British Columbian females, here considered, were fully adult and the hind femora were all 9.5 mm. or over, except in three specimens in which they were 9.0 mm. The femora of nymphs, as stated by Caudell, rarely exceeded 8 mm.

THE MALE

In the series of fifty males, which we are considering, there is considerable variation shown in the distribution of the dark markings on the pronotum and in the rugosity of the surface of its posterior lobe. There is also considerable variation in the total length of the body and in the length of the hind femora.

In examining the pronota of this series, we find that there are three color varieties which gradually grade one into the other. The first variety is by far the most plentiful, sixty-two per cent. of the specimens falling into this division. In these the posterior lobe is either (A) nacreous, (B) luteous or (C) a pale pinkish-brown and is sharply separated from the dark anterior lobe.

In the second or intermediate variety the average specimen shows a more gradual graduation of color from the dark anterior lobe to the lighter, though strongly infuscated, posterior lobe. Being an intermediate variety, it was found hard to place some specimens with certainty, but thirty-two per cent. of the series were considered to fall within this variety; specimens could be found grading imperceptibly into both the lighter variety and the dark variety.

The third, or dark variety, was rare in this series, only three specimens or six per cent. being found. In two of these the anterior and posterior lobes were uniformly black with two slightly lighter areas in the centre. In the pronotum of the third specimen the anterior lobe is slightly darker but less shiny than the posterior lobe, and is, in many respects, intermediate.

Other points of variation can be noticed in the general shape of the pronota and in the rugosity of the posterior lobes. In the series having light pronota, individuals could be found showing variations from a weakly punctate posterior lobe but little rugose, through various degrees of roughness to one that is coarsely ridged longitudinally. In three specimens with light pronota the posterior lobe was considerably flattened and the greatest width was across the hind border, and in these individuals the coarse ridging was particularly pronounced. In the intermediate series of sixteen species no outstanding variation in the degree of roughness was noticed.

In summing up the characteristics of the fifty males no definite varieties can be picked out from this series in which size, color of pronotum, and rugosity are constant in more than one or two specimens. Those in the first series (A), (B) and (C) contain small, medium and large specimens, with the posterior lobe usually weakly punctate to strongly punctate, or occasionally coarsely ridged longitudinally. Both size and rugosity of pronotum are variable in the second and third series, but none have been seen as yet with the coarsely ridged pronotum. The three dark males were among the smallest specimens measured.

The described variety, *Cyphoderris monstrosa piperi* Caudell, the description of which appears in the Jour. N. Y. Ent. Soc., p. 53, Vol. XII, 1904, was not found in the series under discussion, although the main points in which it is said to differ from the type specimens of *C. monstrosa* Uhler are to be found in some of the British Columbia individuals, but never united in one specimen. Its greater size is equalled and in some cases exceeded in the series before us. Its black coloration of the pronotum is found in at least two specimens of the series, but not accompanied by a large or coarsely ridged posterior lobe, while its broad posterior lobe conspicuously and coarsely ridged longitudinally is shown only in the three specimens with light colored pronota. It is doubtful in our opinion whether *C. monstrosa piperi* can be considered a true variety.

The largest specimen in the series of males examined measured: Length to end of cercus, 35 mm.; length of pronotum, 9.0 mm.; greatest width of pronotum, 8.5 mm.; length of tegmina beyond pronotum, 11.0 mm.; length of hind femur, 12.5 mm. This specimen had a very light colored posterior lobe of

the pronotum which was very slightly punctate. The smallest specimen measured: Length to end of cercus, 21 mm.; length of pronotum, 7.0 mm.; greatest width of pronotum, 6.5 mm.; length of tegmina beyond pronotum, 7.0 mm.; length of hind femur, 8.5 mm. The average measurements for the fifty males were: Length to end of cercus, 25.78 mm.; length of pronotum, 8.184 mm.; greatest width of pronotum, 7.81 mm.; length of tegmina beyond pronotum, 8.36 mm.; length of hind femur, 10.67 mm. Another specimen measured: Total length, 35.0 mm.; length of pronotum, 9.0 mm.; greatest width of pronotum, 8.0 mm.; length of tegmina beyond pronotum, 11.0 mm.; length of hind femora, 12.00 mm.; length of hind tibia 11.0 mm.; length of hind tarsus, 7.5 mm.; length of cercus, 3.5 mm. This specimen belonged to the intermediate variety as regards coloration of pronotum. The tegmina of the male are broad and ample and cover from one half to two thirds of the abdomen. The right tegmen may overlap the left or vice versa. The stridulating area is well developed. The wings are shrunken, wrinkled and useless and are far more developed in some specimens than in others.

LIFE HISTORY AND HABITS

The notes obtained on the life history of this insect are far from complete but may be of interest at this time, as little is known about this species. As far as we have been able to ascertain in British Columbia, the periods during which the egg, the nymph and the adult are present are not very well defined; the nymph, at any rate, can be found throughout every month of the year.

No observations have been made on the place chosen for oviposition. The large body of the female and the very short ovipositor would indicate that the eggs are probably either deposited on the soil surface beneath rubbish or logs, or more probably are all laid in one batch in some underground chamber excavated by the female, but this needs to be verified. Dissection of dried females shows that they contain from 45 to 50 eggs. These eggs are all of the same size, which would favor the idea that all are laid at one time and not a few at a time, as occurs in other British Columbia Tettigoniidae, such as the members of the Decticinae, in which the eggs are found in all stages of development within the bodies of the females. The dried eggs measure 4 mm. by 2 mm. and are a dark golden brown color, but the fresh eggs would probably be considerably larger.

Oviposition probably commences in the middle of May and continues throughout June and July and females with mature eggs have been found in early September. There does not seem to be much doubt that the eggs laid late in the summer do not hatch until the following spring, as very small nymphs can be found in May and June which become adult in July. The earliest adults undoubtedly result from the over-wintering nymphs, which can be found in early spring stiff and dormant in their hibernating galleries beneath stones and logs. These overwintering nymphs are usually in the last instar and soon become adult when spring opens. A hibernating nymph was found beneath a small stone in the forest at Riske Creek, Chilcotin, on April 12th, 1921. At this time the snow was still covering most of the ground and the stone was firmly frozen to the soil. The nymph, a male in the last instar, was resting in a smooth, sloping gallery excavated in the soil beneath the centre of the stone. The gallery was about four inches long and sloping gently downwards. The nymph at this time was

very weak and sluggish. In the spring of 1922 several of these were found in short galleries beneath stones on a rocky hilltop on the Nicola range, at an altitude of 3,500 feet. In this location the wind would keep the hilltop fairly free from snow, and as the temperature falls in this locality to fifteen or twenty degrees below zero for several short periods during the average winter, these hibernating nymphs are able to stand a considerable amount of severe cold. Very small nymphs have occasionally been found beneath logs in early spring, and may have wintered in this stage or may possibly have hatched in some underground gallery and grown slightly by feeding on grass roots or other vegetable matter. We have no evidence to show that adults ever hibernate. The nymphs remain hidden during the daytime and come out at dusk, and may be found in great numbers during late May, in company with the earlier adults, feeding upon the flowers of various bushes, especially species of *Amelanchier*. When disturbed they drop to the ground and crawl under the debris at the base of the bushes. When further annoyed they throw themselves upon their backs and extend their legs out rigidly and make jabs at the intruder with their front pair of legs and their powerful mandibles. This same method of defence is used by the adult insect also, and their powerful jaws are capable of giving the finger a severe pinch.

The habits of the adults are similar to those of the nymphs, the day being spent in short burrows beneath stones, under logs or amongst rubbish. They are very slow and clumsy while upon the ground, but can climb freely into the bushes or into the highest trees. Motionless adults on the ground are very hard to detect even with a strong light at night, as their colors blend admirably with the dead twigs and leaves. When the *Amelanchier* bushes are in flower these insects, both nymphs and adults, may be seen in large numbers at night feeding upon the flowers of these bushes, and the air will be filled with the loud shrilling of the males. When stridulating the male rests head downward on a tree trunk or branch and by the vibration of its tegmina produces a shrill ticking sound somewhat similar to that made by the Cicadas. The sound is very ventriloquial and the cinger hard to detect. Very little attention is paid to a bright light. In collecting the series at Nicola a 300 candle-power gasoline lantern was used and could be brought to within six feet of the stridulating males before they would become silent. By taking care not to shake the bushes no difficulty was experienced in gently taking the specimens required with the fingers.

The adults emerge at dusk and the males begin to stridulate. Between 8.30 p.m. and 11 p.m. the stridulating is at its height. After midnight they become silent and probably retire to their hiding places before the chill morning hours. It is only when flowering bushes are in blossom that large numbers can be found together. After the blossoming period they become scattered and are hard to find in any numbers.

Pairing of the sexes takes place soon after dusk and the females may oviposit at night or perhaps during the day time when below ground, but this point has not yet been determined. We do not know if pairing takes place upon the ground or in the bushes, but it is evidently a similar process to that employed by the *Decticinae*, as a number of female *Cyphoderris* have been seen by us with the large, white, albuminous mass adhering to them while feeding on *Amelanchier*

flowers soon after dusk. Another insect which pairs in a similar way at dusk in British Columbia is *Scudderia furcata* Bruner.

During the period when this species is most plentiful it may be found in all types of country from the Rocky Mountains in the east to the Coast Range in the west. We have no records of it at present from west of the Coast Range. It seems to be equally at home in the dry belt and in the more humid sections of the Province. Its normal habitat is evidently timbered land. In the Chilcotin district a number of them were found during the day hiding under loose stones and dried cattle manure on the open range, although they were never far from the timbered hills.

This species is known from Banff, Alberta, and from Washington, Oregon, Idaho and Wyoming in the United States. No damage has as yet been reported from this species in British Columbia, but considerable damage to the buds and flowers of cherry, peach, apple and pear trees has been reported from Idaho.

THE LIFE HISTORY OF *JALYSUS SPINOSUS* (SAY). (NEIDIDAE, HETEROPTERA)

BY P. A. READIO,

Kansas University, Lawrence, Kansas.

Late in September of the fall of 1922 the writer discovered that the stilt-bug, *Jalysus spinosus* (Say), was present in large numbers in the vicinity of Lawrence, Kansas, feeding for the most part on *Gaura biennis* L. All stages of the insect were represented, and it seemed to be an excellent opportunity to obtain some of the much-needed data on the biology of this insect and the family which it represents. Although the lateness of the season made it improbable that a complete life cycle could be witnessed before cold weather, yet the lack of information concerning this insect made the attempt worth while.

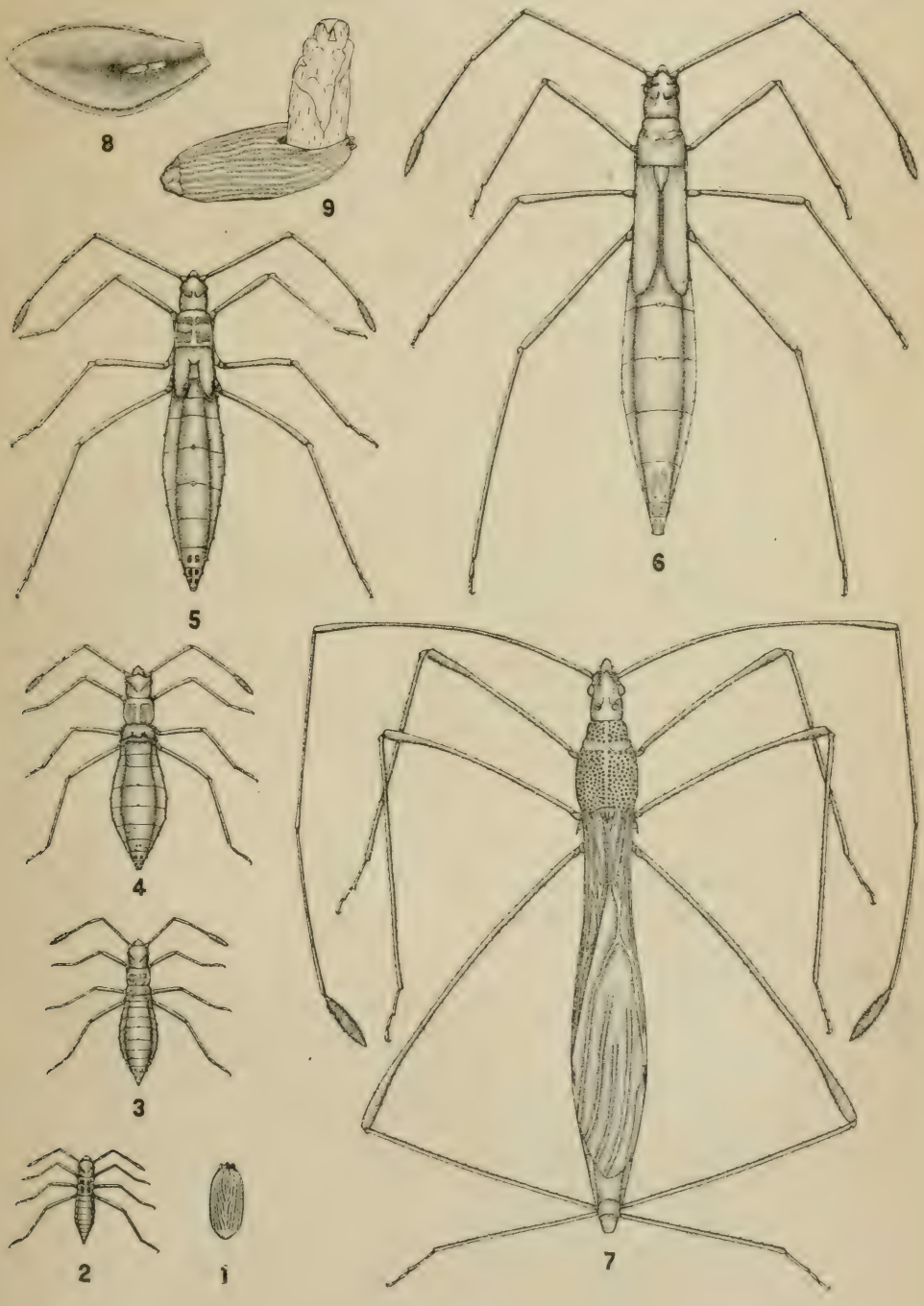
In a survey of the literature dealing with the biology of this family, a few references to the biology of European species were found, but practically nothing in regard to our species. E. A. Butler, in an article, "A Contribution Towards the Life History of *Berytus clavipes* F.,"[1] has described the eggs and nymphal instars of this English species, and in a later article[2] has described the eggs and first instar nymphs of *Berytus signoretti* Fieb. Other observations on the life history of this family have been made by Moncreaff, on *Metatropis rufescense*, Herr.-Schaff., and by Sahlberg on the same species. In this country practically nothing has been done on the life history of any member of this family. Howard, in "Insect Life," states that *Jalysus spinosus* is often "Found on the undergrowth in oak woods," and "would be a good species to study carefully." Comstock in his "Manual for the Study of Insects," states that *Jalysus spinosus* is "Found on the undergrowth of woods and in meadows." Because of the lack of information concerning the life history of this and other American species of this family, the writer has made this brief study.

SYSTEMATIC POSITION.

Jalysus spinosus (Say) belongs to the family Neididae, formerly the family Berytidae, of the order Heteroptera. The following descriptive remarks con-

1—Ent. M. Mag., 49, pp. 28-32. 1913.
2—Ent. M. Mag., 50, pp. 220-221. 1914.

CAN. ENT. LV. PLATE II.



JALYSUS SPINOSUS (SAY).

cerning the family are given by McAtee in his "Key to the Nearctic Genera and Species of Berytidae."[3]

"The Berytidae are an assemblage of small to medium sized bugs of slender build. The long filiform antennae are distinctly elbowed and the head has a definite constriction or transverse sulcus in front of the ocelli. The first joint of the antennae and the femora are clavate, and the slender legs are more or less thickly beset with short bristles or bristled tubercles. The scutellum is small, leaving the triangular space between the clavi partly open.

"It has been the custom to refer to certain metathoracic tubercles of the Berytidae as breathing-horns, or the equivalent of that term in various languages. It is evident, however, that these organs in their entirety are exact homologues of what are called in the other groups of the Heteroptera possessing them "ostioles," with their accompanying canals and tubercles, which are believed to be the orifices through which the odoriferous secretions of the bugs are given off."

McAtee describes the genus *Jalysus* Stal as follows:

"Front of vertex with or without spine; thorax with distinct callosities; sides and median line very low carinate and area within humeri elevated; scutellum with short, sharp, posteriorly inclined spine; elytra spineless, corium not conspicuously punctate; ostiolar process shorter, less curved. and not twisted, canal entirely on the outer side, apex of process a rather long spine; beak nearly or quite attaining hind coxae; no indication of rostral position on under side of head; sulcus beginning at middle of prosternum, narrow and shallow between fore coxae; much wider on metasternum, flanked on each side by 5-6 indentations, abruptly contracted as it passes between the middle coxae, then widened again on metasternum, but not attaining width of part anterior to coxae, the whole meso- and metasternal parts of sulcus with distinct, carinate edges; sulcus fairly well developed on first abdominal segment, percurrent, with broad flat longitudinally wrinkled margins."

McAtee separates the two species in this genus by the following key:

"Front of vertex with a long, sharp, sometimes decurved spine; scutellar spine depressed, almost horizontal ..... *elongatus* Barber.

"Front of vertex without spines, scutellar spine inclined at an angle of 45 degrees ..... *spinosus* Say."

The additional description of the species *spinosus* follows:

"This species is distinguished from all others in the United States by having the ostiolar process tipped with a distinct spine.

"General color, yellow brown, with last antennal joint except its base and apex, eyes, apex of corium, tips of tarsi, and sometimes irregular spots on thorax, and longitudinal vittae on venter, fuscous to black. Length 7-9 mm."

LIFE HISTORY

Host Plants and Feeding Habits: *Jalysus spinosus* has been found feeding on three host plants in this vicinity. These are *Gaura biennis* L., *Gaura coccinea* Pursh., and *Oenothera biennis* L., the Evening Primrose. It is worthy of note that all three of these plants belong to the family Onagraceae. The eggs have been found on *Gaura biennis* and *Oenothera biennis*, but not on *Gaura coccinea*.

In feeding the insects of all stages gather in clusters around the buds

3—Journ. of N. Y. Ent. Soc., XXVII, pp. 79-92.

and seeds. They seem to feed but little, if any, on the leaves and stems, preferring the other parts when they can get them.

Seasonal Life History: Because of the fact that the present observations were made only from late September into the winter months, parts of the seasonal life history are in doubt. The insect hibernates, as do the greater number in this order, in the adult stage under grass and leaves in protected places. They can be found during the winter months among and under the leaves of common mullein, which forms a winter rosette sought as shelter by a good many insects. They are present in the field until late in the fall in all stages; eggs, all stages of the nymphs, and adults having been observed in late October. However, as the colder weather comes, they become fewer in number and finally disappear from the food plants. The latest date upon which they were observed was November 5th, and the last individuals seen were fifth instar nymphs. It is assumed that the adults had already gone into winter quarters and that the smaller nymphs had been killed by the cold weather, while the larger nymphs remained on the food plants only until their final molt could take place. The time of emergence in the spring has not been determined, nor has the number of generations, though it is probable that there are several during the year.

Eggs: The eggs of this species are laid on the food plant, usually attached to the stems or the seeds. They appear to be parallel to the surface to which they are attached, but in reality are inclined at a slight angle, the caudal end being attached and the cephalic end free. Oviposition has been observed and noted. The ovipositing female takes a firm stand, appearing to lean forward on her long, slender legs. At the beginning of oviposition she applies the tip of her abdomen to the surface upon which the egg is to rest, forces the egg out until it comes in contact with the surface, and then becomes motionless for a while. During this time the sticky secretion which fastens the egg to the plant is exuded, allowed to flow around the exposed end of the egg and glue it in place. After the egg is attached the female slowly bends her body still farther forward and actually withdraws her abdomen from around the egg, rather than forcing the egg out. The entire operation takes from two to three minutes. The eggs are laid singly, characteristically, but occasionally two or more are seen side by side or end to end.

The eggs (Figs. 1, 8 and 9) are elongate oval, 0.9 mm. long by 0.3 mm. wide, only slightly, if any, wider at the cephalic end than at the caudal end. They are marked with numerous longitudinal furrows which run the entire length of the egg. At the cephalic end there is a group of four knob-like prominences which are bent inward. These knobs are probably micropylar in function. The eggs are a translucent white when first laid, but in a few days take on a yellowish tinge, which gradually deepens until it becomes a deep yellow just before hatching. The eye spots also show through as red dots in the later days of the development of the embryo.

The number of eggs laid by a single female has not been determined satisfactorily. The greatest number laid by any female in the laboratory was twelve, but it is probable that in the field more eggs are laid. The length of time before hatching varied from seven to ten days, and the average length of time for all the eggs which hatched in the laboratory was eight and one-third

days. This, also, may vary somewhat from the length of time necessary for hatching in the field.

In hatching, a longitudinal split occurs near the cephalic end and the nymph works its way out through this split with its head foremost. It emerges at right angles to the long axis of the egg, and before it is entirely clear of the shell the post-natal molt takes place. The exuvium of this molt is left attached to the old shell and appears as an indefinite, ephemeral membrane.

Length of Nymphal Instars: As has been mentioned before, the season was late when this work was begun, and consequently it was thought wise to run the life history by installments. Consequently mating pairs, eggs, and all stages of the nymphs were started simultaneously with the idea of piecing the life history together in case the cold weather should put a sudden stop to it. Fortunately, however, the complete life cycle of a single individual, from adult to adult, was obtained, in addition to the fractional data.

The period between mating and oviposition is short. In case a mating pair were isolated one day, eggs would be found in their container the next. Egg laying was continued over a period of from two to four days in the insectary.

Records of ten nymphs passing through the first instar are available. The minimum length of time necessary was three days and the maximum eleven days The average for the ten individuals was seven and one-half days.

Two days were required as a minimum and eleven as a maximum for the second instar. The average of ten specimens was four and eight-tenths days.

A minimum of two days, a maximum of nine, and an average of five days for nine specimens was required for the third instar.

The fourth instar required three days as a minimum, nine days as a maximum and four and eight-tenths days as an average of nine individuals.

The fifth instar required four days as a minimum, ten days as maximum and seven and six-tenths days as an average of ten.

The story of the life of the individual that completed its life cycle is as follows:

On September 30th a mating pair was isolated and fed. On October 1st three eggs were found in their container, on October 2nd three more eggs, and on October 3rd, one more egg, making a total of seven laid by this female. On October 10th, eight days after being laid, the three eggs laid October 2nd hatched. Two of the nymphs died in the first instar. The other molted to the second instar on October 17th, seven days; to the third instar on October 25th, eight days; to the fourth instar on October 27th, two days; and finally to the adult on November 4th, five days. This gives a total of thirty-three days from adult to adult. The length of time from the emergence of the adult to the pairing of individuals has not been determined. The length of time of this life cycle indicates that there is ample time for several generations during the summer, as is probably the case.

DESCRIPTIONS OF THE INSTARS

First Instar (Fig. 2): Range in size, 0.9 mm to 1.2 mm.; general shape nearly cylindrical, abdomen slightly swollen in older individuals; general color light yellow with the legs, antennae, beak, upper thoracic segments and tip of

the abdomen darker, and the eyes red. Head bluntly rounded, vertex very broadly rounded, two converging white lines run diagonally caudad from the eyes, nearly meet, and continue parallel to each other to the caudal margin of the head. Pronotum larger than mesonotum which in turn is larger than metanotum; a median, light line runs the length of the thorax. Legs and antennae long and narrow, but proportionately not so long nor so narrow as in the later instars and adult; tarsi two-segmented as is the case in the nymphal instars but not in the adult, where the tarsi are three-segmented; beak four-segmented as in all nymphal instars and adult. The abdominal spiracles are visible laterally but are rather inconspicuous; the upper surface of the body, legs and antennae are clothed with fine, short hairs.

Second Instar (Fig. 3): Range in size, 1.6 mm. to 2 mm.; general shape of body narrowly pear-shaped; general color light yellowish-green with legs, antennae and beak fuscous and eyes red. White lines on head as in first instar. Pro-, meso- and metanotum as in first instar with proportional increase in size. Abdominal spiracles more easily visible than in first instar; openings to stink glands, which are easily visible in the third instar, now very indistinct; fine hairs present on body, legs and antennae.

Third Instar (Fig. 4): Range in size, 2.3 mm. to 3.1 mm.; general color light green with legs, antennae, beak and tip of abdomen fuscous and with a white line running the length of the body, eyes red; body somewhat more elongate than in the preceding instars. Converging white lines on head as in preceding instars. Wing pads beginning to appear, mesothoracic wing pads longer than metathoracic, do not cover first abdominal segment. Openings to stink glands now conspicuous on the posterior margins of the third and fourth abdominal segments; spiracles conspicuous laterally on the segments of the abdomen; three tip segments of abdomen bear dark dorsal plates which bear hairs; fine hairs on the upper surface of the body, the legs and antennae.

Fourth Instar (Fig 5): Range in size, 3.9 mm. to 4.6 mm.; general color light green with legs, antennae, beak and tip of abdomen fuscous and with a median white line running the entire length of the body, eyes red. Converging white lines present on head, vertex rounding, no trace of the ocelli, which appear in the fifth instar. Pronotum darker, lateral margins white-lined, wing pads larger, all extending to the middle of the second abdominal segment, the first pair nearly hiding the second. Openings of stink glands present on the posterior margins of the third and fourth abdominal segments, openings enclosed in a white circle; spiracles of abdominal segments conspicuous laterally; tip three segments of abdomen with darker dorsal plates bearing a few hairs; fine hairs present on upper surface of body, legs and antennae.

Fifth Instar (Fig. 6): Range in size, 6 mm. to 6.9 mm.; general color greenish with legs, antennae, beak, wing pads and tip of abdomen fuscous, eyes red, an interrupted white line running the length of the body; body, legs and antennae very long and narrow, approximating condition in the adult. Vertex more pointed than in the preceding instars, a suture running from the side of the head just below the eyes in a caudo-mesad direction until it nearly reaches the median line, then turning cephalad for a short distance; ocelli present just caudad of this suture. Lateral margins of the prothorax white-lined; at right angles to the median white line are two dark, curved lines which extend nearly

to the lateral margins; wing pads much larger than in the preceding instar, nearly equal in length and similar in shape, median and lateral margins of each nearly parallel, reach middle of third abdominal segment. Openings of stink glands conspicuous, in the same position as in the preceding instar; a single opening in each segment; spiracles easily visible but not as conspicuous as in the preceding instar; seven pairs present on abdominal segments two to eight; three dorsal plates present at the tip of the abdomen bearing hairs.

REVIEW OF LIFE HISTORY

Jalysus spinosus (Say) is an herbivorous insect, having been found feeding on three host plants. *Gaura biennis*, *Gaura coccinea* and *Oenothera biennis*. It winters as an adult under leaves. Its elongate-oval eggs are glued to the stems and seeds of the host plants, and are characterized by longitudinal furrows and four button-like knobs at the cephalic end. In from seven to ten days the egg hatches leaving a post-natal molt skin attached to the shell. There are five nymphal instars, each of which requires from two to eleven days for completion, the average length of time necessary for each being five days. The length of time necessary for a single individual to run through its life cycle from adult to adult is thirty-three days. There are probably several generations a season.

EXPLANATION OF PLATE

Fig. 1. Egg of *Jalysus spinosus* showing longitudinal furrows and micropylar knobs.

Fig. 2. First nymphal instar. Fig. 3: Second nymphal instar. Fig. 4.: Third nymphal instar. Fig. 5: Fourth nymphal instar. Fig. 6: Fifth nymphal instar. Fig. 7: Adult.

Fig. 8. Two eggs of *Jalysus spinosus* attached to seed of *Gaura biennis*.

Fig. 9. Egg after hatching of nymph showing exuvium of post-natal molt attached to shell.

A NEW DOLICHOPODID FROM ONTARIO (DIPTERA)*

BY C. HOWARD CURRAN,

Ottawa, Ont.

Dolichopus lundbecki n. sp.

Infra-orbital cilia black; front purplish; hind femora with two or three preapical bristles, with long black cilia below; last joint of fore tarsi compressed, of small size. Allied to *pachycnemus* Loew but that species has three joints of fore tarsi compressed, only one preapical bristle on hind femora.

Length, 5-5.5 mm. *Male*. Face not wide, silvery yellowish white, black just below the antennae. Front metallic violet, the orbits and just above the antennae greenish, rather dull. Antennae black, less than the lower half of the first joint and the base of the second joint below, reddish yellow; third joint one and one-half times as long as wide, convexly tapering to acute point, the arista inserted at apical third. Occiput grey pollinose, the green ground color not very evident; orbital cilia wholly black. Palpi reddish yellow.

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*Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

Mesonotum rather dark green, with four bronze-purple vittae, the median ones approximate and complete; the whole lightly grey pollinose. Pleura largely blackish, partly green, rather thickly whitish pollinose. Squamae yellow with black cilia. Halteres yellow.

Legs reddish yellow. Fore coxae with a small black spot at base on outer sides, entirely clothed with small black bristles in front, and five long apical ones. Middle and hind coxae black with yellow apices. Posterior femora with a small apical black spot above; middle and hind femora each with three preapical bristles in a longitudinal row; hind femora with long black cilia on lower inner side, the cilia not dense, longer than the width of the femora Apical fifth of hind tibiae black; middle tibiae with one bristle on ventral surface about the apical third; posterior tibiae swollen, widest at basal third, the bristles on their outer surface arranged in two rather regular rows, the hairs on the ventral surface rather long; fore tarsi longer than their tibiae, yellow, only the fifth joint black; basitarsi as long as the two following joints, the remaining joints each successively a little shorter; fifth joint nearly twice as long as wide, its apex rounded, widest sub-apically, gradually tapering to the base; front tarsi slender; middle tarsi black from tip of first joint, their basitarsi without a bristle above; hind tarsi wholly black.

Wings with a small, enlongate enlargement before the tip of the first vein; fourth vein bent slightly beyond its middle. Posterior margin of the wing very deeply excised before the tip of the sixth vein: it is gradually narrowed from the tip of the fifth vein to a point immediately behind the inner end of the costal swelling, the sixth vein is surrounded by a large roundish lobe.

Abdomen metallic green and purple black, the latter color occupying each segment on either side of the incisure and forming a less deeply colored middle vitta. The green color is thinly white pollinose. Genitalia black; their lamellæ similar to *D. pachycnemus* (see fig. 82, Bull. 116, U.S.N.M.), but perhaps slightly longer.

Female.- Face wider, its sides almost parallel, silvery white; second antennal joint not at all yellow in my specimen. Otherwise, similar, the legs plain, the last joint of the fore tarsi very slightly enlarged.

Holotype and *Allotype*, "Mer Bleue," Ottawa, Ontario, June 7, 1923. (Curran), No. 613, in the Canadian National Collection, Ottawa.

This species is most distinct from any so far described and should be readily recognized by the black orbital ciliae, front tarsi and wing pattern. It traces out to *D. pachycnemus* in the Van Duzee, Cole and Aldrich key, (Bull. 116, U. S. N. M.). The ♂ may be readily separated by the presence of three bristles before the end of the middle and hind femora, only apically black tibia, etc. *D. pachycnemus* has three joints of the front tarsi compressed, only a very slight wing lobe and the hind tibiae are widest at the middle. The ♀ traces out to *bruesi* V. D., C. & A., but may be readily distinguished by the violet front, small black spot above apex of hind femora, and black tipped tibiae.

I take great pleasure in naming this species for Dr. William Lundbeck, whose excellent Monographs of Danish Diptera are so well known.

NEW SPIDERS FROM CANADA AND THE ADJOINING STATES. No. 3.

BY J. H. EMERTON,
Boston, Mass.

Since the second paper of this series was published in 1919 many Canadian spiders have passed through the writer's hands, among which several species appear to be undescribed, but have waited for publication in the hope that more specimens of the same kinds might be found. The new *Grammonota* from the southern end of James Bay is represented only by one of each sex, though it is probably abundant like other species of the genus. Three other species are known by only one male each. The three *Cybaeus* have long been described and named, but much new material makes it easier to distinguish the species and so new descriptions and figures have been given.

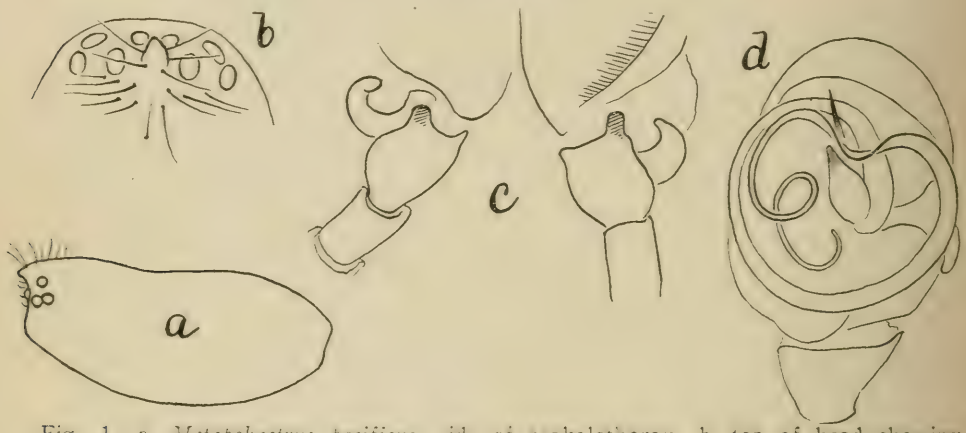

Fig. 1.—a, *Metapobactrus pacificus*, side of cephalothorax; b, top of head showing short horn; c, tibiae of male palpi; d, under side of palpal organ.

Metapobactrus pacificus n. sp.

Cephalothorax 1 mm. long. Color light yellow without any markings on cephalothorax or legs. The cephalothorax has the head slightly raised and with a short, pointed horn directed forward between the upper eyes, which are twice as far apart as they are from the lateral eyes. The front row of eyes is shorter than the upper row and has the lateral pair larger and the middle pair smaller than the eyes of the upper row. (Fig. 1, a, b.) The sternum is as wide as long and extends backward between the posterior coxae, which are their diameter apart. The abdomen is broken off and lost. The male palpus has the tibia a little longer than wide with a short, dark process at the outer corner and a smaller uncolored one on the inner corner. (Fig. 1 c.) This differs from the tarsus in *Cornicularia*, which genus is suggested by the process on the head. The palpal organ has a long tube, which coils over the under side of the palpal organ in one and a half turns. (Fig. 1, d.)

One male only. Terrace, B.C., Mrs. Hippisley, 1920.

Gongylidium columbianum n. sp.

3 mm. long. Cephalothorax and legs orange brown, abdomen gray. The cephalothorax is oval and the head low and the general appearance is much like *Gongylidium macrochelis* Em. described in Canadian Entomologist, Aug. 1917. The mandibles are stout and have a long tooth on the front near the lower end,

curved inward and downward. The front of the mandibles is roughened with short elevations. (Fig. 2, a.) The male palpi have the patella long with a slight spur at the end on the under side. The tibia is twice as long as wide and extends in a hook over the tarsus with a sharp point and a tooth on the inner side. (Fig. 2, b.) The tarsus is as long as the tibia and the palpal organ is large, extending beyond the tarsus on the under side. The tube is long and slender, curving in two circles around the main part of the organ. (Fig. 2, c.)

One male, Terrace, B.C. Mrs. Hippisley, 1920.

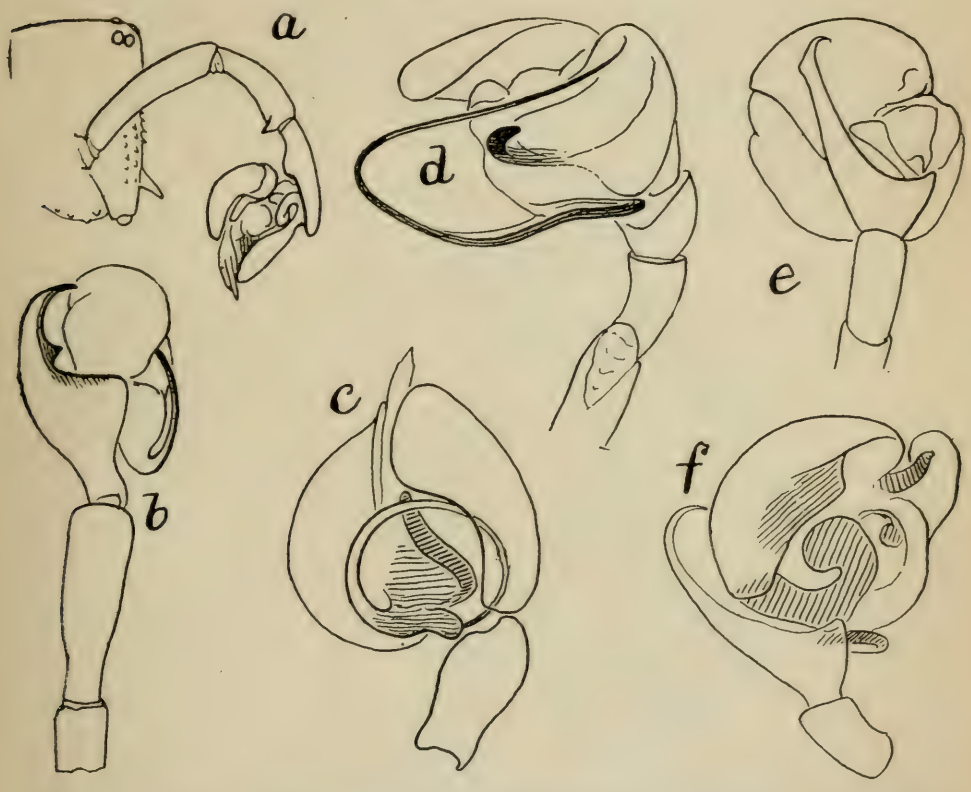

Fig. 2.—a, side of head of *Gongylidium columbianum*; b, c, male palpus of *G. columbianum*; d, e, f, male palpus of *Araeoncus pedalis*.

Areoncus pedalis n. sp.

2 mm. long and entirely pale. The cephalothorax is low without any elevation of the head. The eyes are as in *A. bispinosus* Em. (Conn. Acad. 1911), the front row shorter than the upper, the front middle eyes smaller and the upper middle eyes larger than the others. The male palpi are large and resemble somewhat those of *bispinosus*. The tibia is short and has a long, slender process on the outer side which extends over the tarsus. This process widens near the end and beyond this it ends in a sharp, curved point. (Fig. 2, e, f.) The tube is slender and long enough to wind twice around the palpal organ. (Fig 2, d.) The tarsal hook is small and flat, curving around in a half circle and with a curved tip.

Dauphin, Manitoba, 1919. Mrs. Hippisley.

Grammonota spinimana n. sp.

In size, color and dorsal markings this species resembles closely *Grammonota pictilis*, the common *Grammonota* in spruce trees all over eastern Canada, but is at once distinguished from it by the slightly thickened tibia of the first and second legs in both sexes. The epigynum is distinctly different from that of *pictilis*. (Fig. 3, e.) In the male the thickened first and second legs have two rows of stiff hairs on the under side of tibia and metatarsus, which are about twice as long and twice as thick as the other hairs of the legs. (Fig. 3, a, b.) The head of the male is not elevated behind the eyes as in the males of *pictilis* and *gigas*, but there is a slight projection forward between the front upper eyes. (Fig. 3, a.) The male palpus has the tibia somewhat like that of *pictilis* with the dorsal tooth larger and the outer process shorter and turned outward. (Fig. 3, c.) The palpal organ is much like that of *G. ornata*. (Fig. 3, d.)

One male and one female only from Moose Island, James Bay, collected by Fritz Johansen in the summer of 1920.

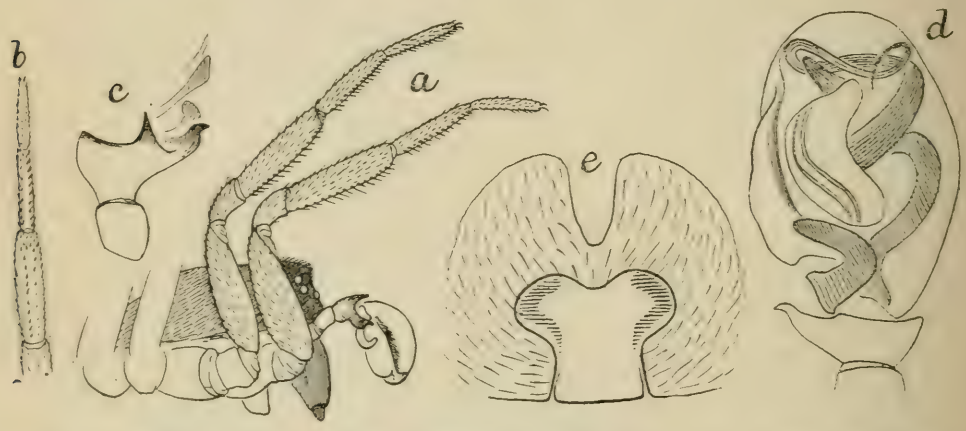

Fig. 3—a, side of male *Grammonota spinimana*; b, first leg of male showing spines on under side; c, tibia of male palpus; d, palpal organ; e, epigynum.

Cybaeus reticulatus, morosus and signifer Simon

These three species of *Cybaeus* form a conspicuous part of the spider fauna of the west coast of Canada. They range from Vancouver Island to Alaska and eastward to the Rocky Mountains, and occur together in many collections as though living together in the same places like the three eastern *Cicurina*. All three were named and briefly described by Simon in the Proceedings of the Entomological Society of Belgium in 1886 and specimens identified by Simon are now in the collection of Nathan Banks with which the recent Canadian specimens have been compared.

Preserved in alcohol, the three species look much alike, all having the same pale yellowish color, with no markings except a row of pairs of light, oblique spots on the back of the abdomen. The characters of the copulatory organs are very distinct. In *reticulatus* the external epigynum is small, with a small opening directed backward, in front of which is a transverse curved ridge. (Fig. 4, b). In *signifer*, the opening is wider, without any ridge. (Fig. 5, d.) In *morosus* there are two openings at the sides of a middle septum and at the sides of these, two oval depressed areas bordered in front by a curved ridge, making a figure somewhat like a pair of spectacles. (Fig. 5, c.)

The male palpi all have a prominent tooth on the outside of the tibia and a process covered with short points on the outside of the patella. In all three the palpal organ has a process at the base, which rests against the tooth on the tibia, and in all three the tube curves in a half circle across the distal end and is supported by a flat thin process parallel to the edge of the tarsus.

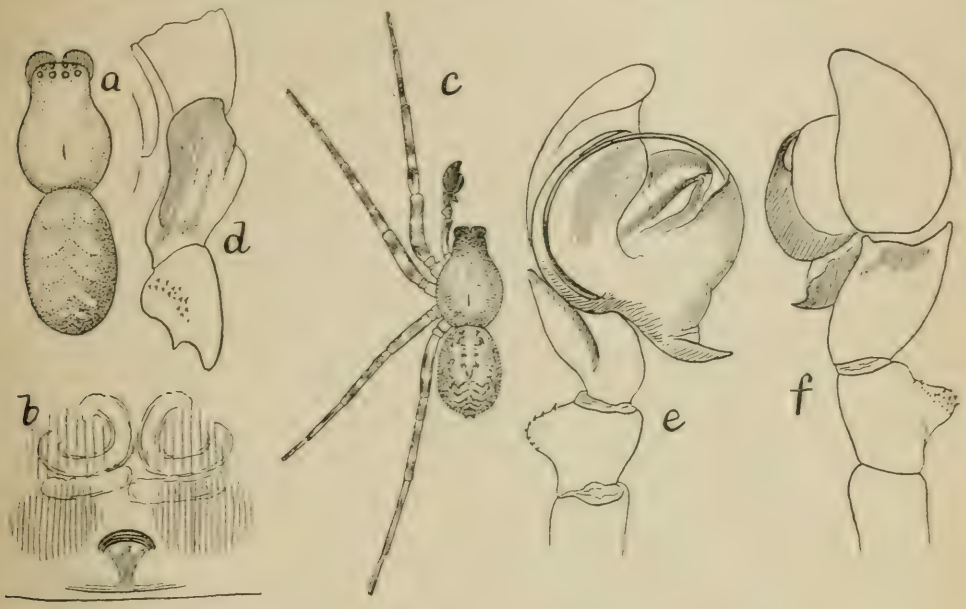

Fig. 4—a, back of *Cybaeus reticulatus* ♀; b, epigynum of *C. reticulatus*; c, *C. reticulatus* ♂; d, e, f, male palpus of *C. reticulatus*.

In *reticulatus*, the palpal organ is large, with a pointed basal process supported by a large tooth on the tibia. The process of the patella turns directly outward without extending forward beyond the end of the joint. (Fig. 4, d, e, f,)

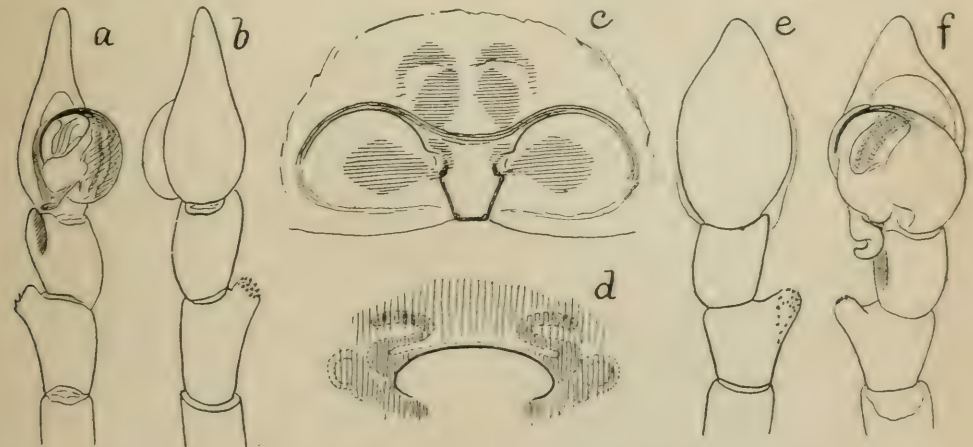

Fig. 5—a, b, male palpus of *Cybaeus morosus*; c, epigynum of *C. morosus*; d, epigynum of *Cybaeus signifer*; e, f, male palpus of *C. signifer*.

In *signifer* the palpal organ is smaller than in *reticulatus*, not wider than

the tarsus, and the tooth on the tibia is correspondingly small. The process on the patella is at the distal end and projects slightly forward beyond the base of the tibia. (Fig. 5, e, f.)

In *morosus,* the whole palpus is more slender and the joints more elongated than in the other species. The tarsus is twice as long as wide, and the palpal organ covers only half its length. The patella is longer than wide and the outer process is at the distal end, extending forward beyond the base of the tibia. (Fig. 5, a, b.)

Cornicularia pacifica n. sp.

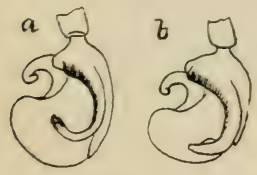

Fig. 6—a, palpus of *C. pacifica*; b, palpus of *C. auranticeps.*

This resembles closely the eastern *Cornicularia auranticeps,* but is a fourth larger, measuring 3 mm. long. The cephalothorax is bright orange in color and the legs are orange at the base and dark toward the ends. The difference from *auranticeps* is shown in the male palpi. The tibia is divided into two branches as in *auranticeps,* but the upper branch is distinctly more slender and curved in a half-circle over the back of the tarsus. (Fig. 6, a.) The same part in *auranticeps* is shown in Fig. 6 b for comparison.

Terrace, B.C., Mrs. Hippisley.

Delorrhipis bicornis n. sp.

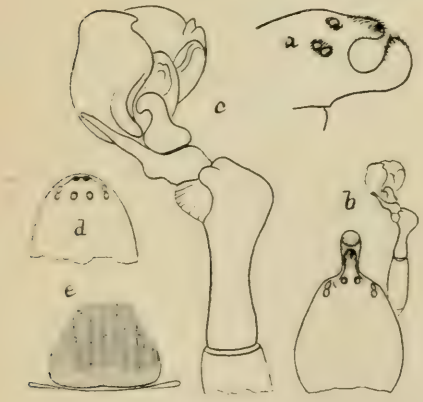

Fig. 7.—a, *Delorrhipis bicornis,* side of head and horns; b, head from above; c, male palpus from above; d, head of female; e, epigynum.

This is the third American *Delorrhipis.* The first, *D.* (*Erigone*) *monoceros* was described by Keyserling from the State of Washington in 1884, and *D.* (*Tmeticus*) *unicorn* by Banks in 1892 from Ithaca, N.Y. The present species is 3 mm. long and chestnut brown with somewhat lighter legs. The male suggests a *Diplocephalus,* having the horn larger than in *D. monoceros* and curved upward at the end where it nearly touches a smaller horizontal, upper horn carrying the lower middle eyes. (Fig. 7, a, b.) The female is of the same size and color as the male and has the lower middle eyes unusually high and slightly projecting forward. (Fig. 7, d.) The male palpi are long and resemble those of *monoceros* as figured by Keyserling. The patella is thickened at the end and turned obliquely inward, the tibia is short and has a long, slender process extending over the tarsus. (Fig. 7, c.) The epigynum is covered by a wide, slightly raised plate and shows no external opening. (Fig. 7, e.)

Terrace, B.C., Mrs. Hippisley.

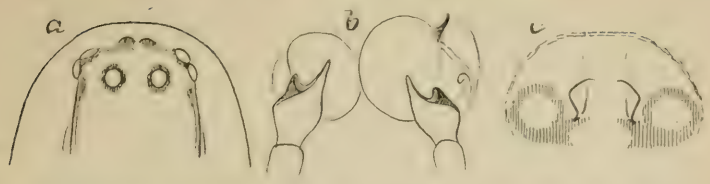

Fig. 8—a, *Lophocarenum minimum*, top of head with grooves; b, palpi; c, epigynum.

Lophocarenum minimum n. sp.

A small species, about 1 mm. long, and pale in color, with the head low and having distinct grooves at the sides leading to shallow pits just behind the lateral eyes. (Fig. 8, a.) The male palpi have the tibia longer than wide, extending over the tarsus in two points, the inner one long and slender and the outer blunt and darker in color. (Fig. 8, b.) The female has the epigynum as in Fig. 8, c, showing openings, with a darkened border, in the middle, and the round spermathecae through the skin at the sides.

Several specimens of both sexes from Terrace, B.C., Mrs. Hippisley.

Lophocarenum inflatum n. sp.

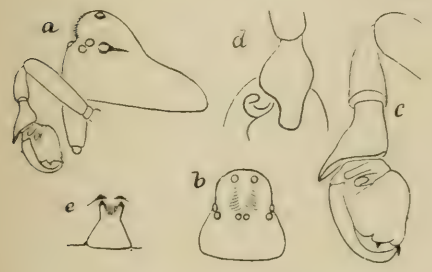

Fig. 9—a, *Lophocarenum inflatum*, side of head with grooves; b, front of head; c, male palpus; d, tibia of male palpus from above; e, epigynum.

This is a pale species of moderate size, a little over 2 mm. long, with a high head resembling that of *cuncatum* and *abruptum*, with the upper middle eyes near the top of the hump. (Fig. 9, a, b.) The grooves in the head are short and the pits large and near the lateral eyes. (Fig. 9, a.) The male palpi are slender and the palpal organs small. The patella and tibia are together as long as the femur. (Figs. 9, a, c.) The tibia extends over the tarsus about one-third its length in a truncated point. (Fig. 9, d.) The epigynum shows a wide middle lobe, in front of which are two shallow pits. (Fig. 9, e.)

Terrace, B. C., Mrs. Hippisley.

THE SPECIFIC NAME OF THE GREEN BUD-WORM

In our Entomological Branch Bulletin, No. 16, entitled "The Apple Bud-Moths and Their Control in Nova Scotia," by G. E. Sanders and A. G. Dustan, the name of the green bud-worm is given as *Argyroploce consanguinana* Wlsm. This determination resulted from correspondence which I had with Mr. A. Busck, of the United States Bureau of Entomology. Recently, however, Dr. J. H. McDunnough, of the Dominion Entomological Branch, has been studying the Eucosmid material in our National Collection of Insects and he informs me that the species which we referred to as *consanguinana* Wlsm., is not this species, but is *variegana* of Hubner. This latter is a common species in Europe and Asia Minor. In England it is known, commonly, as the Allied Bud-Moth. Entomologists, as well as librarians who have the above publication, should note this correction.

ARTHUR GIBSON, Dominion Entomologist.

TWO NEW DIPTERA IN THE CANADIAN NATIONAL COLLECTION, OTTAWA.

BY C. B. D. GARRETT,
Cranbrook, B. C.

Philorus aylmeri new species.

Male. Eyes bisected about midway. Antennae blackish brown. Rostrum deep yellow, palpi yellow. General colour yellowish, some portions infuscated. Halteres dusky, only the base yellow. Abdominal tergites dark brown, the last segment yellow, almost without hairs; sternites yellow. Legs yellow, shading to darker on the tarsi. Hind tibia with one small apical spur. Basal two-thirds of the claws much swollen, finely pilose along the under side. Coxae yellow, a small black spot on the apex of each in front. Wings very similar to *P. bilobata* of Europe, the submarginal cell long, reaching the RM crossvein; RS over twice as long as the latter. R_{2+3} and R_{4+5} divergent at their tips. Cu_1 appears to rise from the M Cu crossvein. Cu_2 holding the direction of the Cu base to the margin; otherwise as in *bilobata* Lw.

Hypopygium forming a distinct hollow cup; the base above on each side runs out into a long appendage pointing inwards to the middle of the cup; the upper corner of the sternite ends in a pair of long claspers bearing hair on inner margins and on apical half exteriorly; from inside posteriorly the center forms a triangular projection on each side of which is a chitinized piece ending in a round tip.

Holotype—♂, Aylmer Creek Falls, Lake Minnewanka, Banff, Alta., Aug. 30th, 1922, (C. B. D. Garrett), No. 589, in the Canadian National Collection, Ottawa.

The wings of this species are mounted on a slide.

Anorostoma raca new species.

Male. Two frontal orbital bristles, the foremost slightly over half the length of the hind one. One oral vibrissa with single row of fine hairs behind. Prosternal bristle wanting. Mesopleura on the posterior edge near the upper angle with one weak and one strong bristle, above these with two short hairs; otherwise bare except for three hairs below the disc. Propleura bearing one strong bristle and one hair about midway up posterior side. Pteropleura bare; sternopleura with one strong bristle and two to four hairs along the upper edge, centrally with four to six fine hairs running down to many bristles towards the middle. General body color wholly yellowish. Four dorsocentral bristles present, the median two with a slightly brownish spot at their bases; scutellum with two pairs of bristles. Fore femora with a dorsal and lower row of bristles, the middle ones with a median row of strong bristly hairs on the outer (anterior) side and two bristles below this row near the apical end; hind femora with a scattered row of bristles along the dorsal edge on apical four fifths, the legs with moderately long, sparse black hairs elsewhere. The wings, which are somewhat damaged, appear to be hyaline with the crossveins infuscated.

Holotype—♂, Aweme, Man., Aug. 11, 1917, (N. Criddle), No. 890, in the Canadian National Collection, Ottawa.

NEW NORTH AMERICAN DIPTERA*

BY C. HOWARD CURRAN,
Ottawa, Ont.

Bibio simplicis new species.

Head black pilose, body elsewhere pale yellow haired, legs almost all reddish; wings pale brownish.

Length of wing, 6—7 mm. *Male.* Head black pilose, the middle of the occiput and palpi mostly, with yellow or intermixed yellow hairs. Antennae short, robust; last two points of palpi sub-equal, palpi longer than antennae.

Thorax and abdomen shining black, only the sides of the collar whitish yellow, the pile wholly pale yellow, long on the thorax, sparse on abdomen Upper genital plate with a broad, apically rounded incision on apical two-thirds

Coxae and trochanters black, yellow pilose. Legs reddish, the apices of the femora, sometimes only obscurely, a dash on the basal two-thirds of the front femora below, sometimes the anterior surface of the fore tibiae on apical half, the last two or three tarsal joints wholly, the preceding one or two apically, black, or the hind tarsi may have only the last joint black, the other tarsi a little more reddish. Front femora rarely somewhat piceous reddish, greatly swollen, scarcely over two and one half times as long as wide; anterior tibia with a large bulbous swelling in the middle below, four times as long as wide, but thicker in the middle than wide, anterior spur as long as the second tarsal joint, the posterior one not over one-fourth as long as the anterior. Hind basitarsus slightly swollen, twice as long as the last joint, the fourth joint of all the tarsi distinctly shorter than the fifth. Tarsi pale haired on reddish portion, black haired on black portions. Pile of femora chiefly yellow, but below, on the front ones, the hind ones wholly, black haired; tibiae black haired, the front ones with chiefly yellow hair. Squamae brown or fuscous with yellow fringe; halteres fuscous.

Female. Front about twice as wide as the width of one eye from dorsal view, with a slender, low median carina which expands above the antennae, with irregular longitudinal strigations on either side, and without conspicuous tubercles. Front black haired, occiput sparsely yellow pilose.

Thorax and abdomen reddish, the margins of both, the postscutellum, apices of the segments of the abdomen, pectus and portions of the pleura, slightly brownish or somewhat piceous. Coxae chiefly reddish, their apices, narrow bases, and the trochanters, piceous; front femora and tibiae slightly larger.

Holotype—♂, Nordegg, Alta., Aug. 1, 1921, (J. McDunnough) No. 588, in the Canadian National Collection, Ottawa.

Allotype—♀, same data, July 26.

Paratypes—6 ♂, same data, July 26, 6 ♂, same data as holotype; 2 ♂, Banff, Alta., Aug. 30, 1909, (N. B. Sanson).

This species is allied to *inaequalis* Loew, but is smaller, the front femora not blackish or brownish, etc. It is nearer *alienus* McAtee but in the type of that species the hind basitarsus is only one and one-half as long as the last joint.

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept., of Agric., Ottawa.

The species of *Bibio* possess few characters suitable for determinations and are extremely difficult to determine accurately from description. Many species appear very much alike and can only be separated by careful study. More than one species may be taken at the same time, which makes the determination even more difficult. I have examined all the types which are at present in America. It will require very careful study of Walker's types before we can be positive of his species and possibly some of those described subsequently will be found to be synonyms.

Ginglimyia bicolor new species

Differs from *G. acrorostris* in wider, dull orange frontal vitta, wider middle portion of face; reddish first two antennal joints, reddish yellow coxae and femora and more yellowish tinted pollen.

Face and cheeks yellow in ground color, the head, except the broad frontal vitta, silvery, the frontal vitta orange, extending along the sides of the ocellar triangle to opposite the hind ocelli; frontal vitta four times as wide as the side stripes, widened on front half. First two antennal joints and base of third reddish; arista black, bare.

Mesonotum greyish yellow pollinose, with four or six darker stripes, the pleura greyish pollinose and more blackish in ground color.

Coxae and femora reddish yellow, the latter darkened above at apex; tibiae brownish red, paler on inside; tarsi all black.

Wings cinereous in front, paler posteriorly; crossvein bent apicad.

Abdomen shining black, the sides of the first segment, the second except a broad, narrowing middle stripe and basal triangles on the third, except usually only the middle third, and sometimes small spots on the anterior angles of the fourth, reddish yellow, basal third or more of the third and following segments yellowish white pruinose.

Holotype—♀, Saanich, B. C., Aug. 13, 1918, (W. Downes), No 593, in the Canadian National Collection, Ottawa.

Paratypes—3 ♀, same data.

This species agrees almost perfectly with Townsend's generic description. There is some variation in the specimens in the direction of the bristles on the front, and they do not always lie as indicated by Townsend, but the orbitals and verticals may vary considerably.

Mailed Thursday, November 8th 1923.

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AN INTERESTING ANT FROM MUSKOKA

BY SHELLEY LOGIER,

Royal Ontario Museum of Zoology, Toronto, Ont.

In the year 1905 Dr. W. M. Wheeler published a revision of the North American species of ants of the genus *Dolichoderus,* in the Bulletin of the American Museum of Natural History; Vol. XXI.

Among the ants treated in this revision is one which he describes under the name of *Dolichoderus taschenbergi,* var. *gagates.* The varietal name, "*gagates,*" he later changed to *aterrimus,* finding the former preoccupied.

Dr. Wheeler found this ant, and *D. mariae* common on the pine barrens of New Jersey where he studied them, and in his revision he gives an interesting account of their habits and of the character of their nests.

His studies show that the North American Dolichoderi represent at least three distinct species: *D. mariae* Forel, *D. plagiatus* Mayr, and *D. taschenbergi* Mayr, and that they are terrestrial in their nesting habits and monodomous—each colony occupying but one nest. They frequently climb bushes and trees in search of plant lice, the honey-dew of which forms a large portion of their food.

The nests on the pine barrens were excavated in pure sand and usually about the roots of brown beard-grass (*Andropogon scoparius*) or of turkey beard (*Xerophyllum setifolium*), the ants digging a pot-shaped cavity 12 to 18 inches deep and 3 to 5 inches in diameter, and the brood was stored in the spaces between the root fibres. Vegetable debris such as bits of dead leaves and pine needles were heaped over the nest entrance, sometimes forming a low mound, but quite as often the surface soil and debris over the nest would settle and become concave owing to the excavation of that beneath by the ants.

I was fortunate enough to have the opportunity to observe and collect this ant and examine its nest while camping in the Muskoka district during the summer of 1919, about a mile and a half down stream from Mary Lake, beside the Muskoka River. One bright, sunny morning, on the 30th of June, while wandering through some light, second growth woods in a dry, elevated region, my attention was arrested by a crowd of shining black ants crawling over a decayed log. They had a long trail established leading from the log along a dead branch, then over the ground to a young balsam tree; and the ants were climbing in large numbers up the stem of this tree. On climbing the tree and following their trail to the top I discovered some very large black aphids with reddish legs (*Lachnus curvipes* Patch), and the ants were attending these aphids. On returning to the log where I first saw the ants, I noticed another trail leading off in a different direction, and followed it in hopes of finding the nest, but on tracing it out, found it led to a white pine tree which the ants were climbing in a continuous file. As before, I climbed the tree and followed the trail to its

ending among the high branches, where I found some more aphids of a smaller species (*Lachnus* sp.) with ants in attendance on them. Both this trail and the one leading to the balsam tree started from the same point on the log. This point, where the trails met, seemed to be a kind of rendezvous and the ants had apparently tunnelled a little into the rotten wood and were making use of the shelter of natural crevices, where they would congregate in considerable numbers.

On their way up the pine tree the ants would stop and rest in little groups in some of the main forks where the large branches left the trunk, although no aphids were present in those places to attract them. It was by following still a third trail leading to and from the little rendezvous in the log that I eventually discovered the nest. It was located at the base of a small maple shrub about 8 or 9 feet from the log. The entrance was marked by a dome-shaped structure built of pine and balsam needles. This dome was about 14 inches in diameter at the base, and perhaps 7 or 8 inches high. The workers were crawling over it in swarms and a few of the winged, sexual forms were also out taking an airing. These latter were very shy, and quickly retreated into the nest on the least disturbance.

On opening the dome, I found in the centre a space of two inches or more in diameter and extending down at least to the base; I did not determine how much deeper. In this space the sexual pupae were stored and large numbers of workers were gathered in thick clusters.

On tearing open the walls of the dome and searching among the debris, I found some lepidopterous larvae living. These caterpillars were of a brownish colour with dark brown heads, and their bodies were sparsely covered with short, stiff bristles. They were not Lycaenid larvae, which one might expect to find in such a location, but were the larvae of a moth. I later sent these caterpillars to Dr. J. McDunnough for examination, and he reported on them as noctuid larvae and probably belonging to the subfamily Hypeninae. The ants were evidently used to the caterpillars because, when I dropped one into the mass of ants in the middle of the nest, it was not hurt nor interfered with, but a fly dropped into the same place was attacked and killed at once; and when the mass of ants were touched with the point of the forceps they clung to it in numbers and bit at it viciously.

They resented bitterly my intrusions and the atmosphere above the nest was pungent with the fumes of their poison glands, which in this case closely resembled formaldehyde in its burning, penetrating odour.

In the vicinity of the nest the ants were very pugnacious and when attending the aphids on the trees they were somewhat so, but while resting in the little rendezvous in the log and when en route on the trails they were very docile and would crouch down or run away sooner than fight.

On the following day at Port Sydney, at Mary Lake, I found another nest of this same species of ant. They had a long, winding trail established leading to a small tree about seventy feet distant by their meandering route, where they were attending aphids. They had also a short trail leading in the opposite direction to some blueberry bushes. Here again aphids were the attraction.

In the case of this nest also, the entrance dome was built of pine and balsam needles, and was sheltered by some small shrubs and brackens. The dome was not so large as that of the nest seen on the previous day, and I could not find any lepidopterous larvae in the walls. These ants had a fondness for travelling under cover as much as possible; wherever there was a dead branch or a piece of board, or any rubbish lying on the ground the trails would follow along beneath these, although in the absence of cover they would not hesitate to travel over the open ground, or even across bare rock.

The colonies of this species are decidedly large; the ants which I saw out on the trails at one time would number many hundreds, perhaps several thousand, and the number within the nest when opened was certainly immense. Here the workers hung together in large clusters. This second nest also contained many males and virgin queens more advanced in development than those seen in the nest found on June 30th, for they were crawling over the outside of the dome in large numbers, evidently getting ready for flight.

Speaking of the sexual phases, Dr. Wheeler records finding, on August 19 and 20, 1905, nests of *Dolichoderus mariae* containing the male and female pupae, mature males and callow females. Dealated and winged females were also running over the ground. On September 16 and 17 he again opened nests of this species, but only in one did he find sexual forms, which were mature and apparently belated females, and no sexual pupae were present. He also searched the nests of *D. aterrimus* on all these dates for sexual forms but did not find any, so he concludes that the nuptial flight must occur earlier in this species. The observations which I had the opportunity to make on this ant in Muskoka would point to the same conclusion, because the nest which I opened on June 30th contained many sexual pupae, besides a good number of winged females and males. And the one opened on July 1st in a more sunny location was apparently on the verge of swarming, as the mature sexual forms were abundant and very active. This species is evidently not abundant in Muskoka, at least not in the region where I was stationed, as I only came across it three times during a period of about ten weeks. The third time was late in August, when I found them attending aphids on some shrubs on the shore of a small lake, and this time I did not succeed in locating the nest. Specimens of the aphids found in company with the ants on the balsam and white pine trees on June 30th were later sent to Mr. W. A. Ross for determination, but owing to the fact that those taken on the white pine were all wingless, agamic females, specific identification in this case was impossible. Mr. Ross then forwarded the doubtful specimens to Dr. A. C. Baker, at Washington, for comparison with specimens in the United States National Collection, but he also found it impossible to run them down any closer than the genus.

The ants were identified by Dr. Wheeler, who, as already explained, was the first to recognize and describe the variety *aterrimus*.

OBSERVATIONS ON THE CHERMIDAE (HEMIPTERA; HOMOPTERA). PART I.

BY G. F. FERRIS,
Stanford University, California.

In the course of a rather careful examination of the North American literature dealing with the family of Homoptera that is usually known as the Psyllidae, I have been unable to find a single description of the immature stages of any species that would permit the positive identification of the species from these stages. In some cases a more or less definite determination may be arrived at by taking into consideration the circumstantial evidence of host and habit, but as far as the insects themselves are concerned, practically nothing can be done unless the adults as well are available. Nor in the course of a confessedly random, but nevertheless fair, sampling of the European literature have the results been any better.

That this experience is not peculiar to myself is indicated by the following statements of Crawford, who has monographed the New World species of the family. He says[1]: "Determination of the species when only the nymphal form is available is quite impossible at present. . . . the best that can be done is to determine, sometimes, the subfamily to which the nymphs belong."

The existence of this situation is probably due in part to the almost complete lack of interest in these immature stages and to that extent it is by no means peculiar to this particular family. But this is probably not all. It appears also to be due in some measure to the methods that have been used in their study. The manner of approach has not been that which would yield the most satisfactory results.

In this, as in all the groups of small insects, the method of study constitutes—in my estimation—about ninety per cent. of the equipment of the student. The first requisite is the possession of preparations that are adequate for the purposes of study. This is a fact that has finally been realized by most of the students of the Coccidae but which seems not yet to have penetrated into the consciousness of those in many other fields. There is still much to be done before the idea is finally hammered home that no amount of labor and no amount of care is wasted that will yield preparations in which it is possible to see clearly the structures that must be seen in order to establish our systematic work on a firm foundation.

As a basis for the studies which will follow, I am utilizing material that has been prepared in the manner now generally accepted in the study of the Coccidae. The specimens are cleared in caustic potash, the body contents removed and the derm stained with magenta. In the case of very heavily chitinized forms these preparations are supplemented by others that are left unstained. There is thus revealed a wealth of structural characters, many of which seem never to have been seen before. I may add that the study of the adults even is not complete without the utilization of such material in addition to the ordinary dry specimens.

In the course of these papers two objects will be kept constantly in view.

1. Crawford, D. C. A Monograph of the Jumping Plant-lice or Psyllidae of the New World. U. S. Nat. Mus. Bull. 85: 17. 1914.

One is so to describe and figure the immature stages as to permit the positive determination of the species concerned in the absence of material for comparison. The other is to arrive at an evaluation of the various characters in order to obtain a classification based upon the nymphs as a check upon that based upon the adults. This second object offers some interesting possibilities. The material already available indicates some agreement and some disagreement with the existing classification. Certain species that are now placed together on the characters of the adults have very little resemblance in their nymphal stages. To what extent the two are reconcilable remains to be seen.

In the preparation of the figures which are to accompany these papers I have adopted as my standard the ideal of showing every structure that can be seen on the body of the insect and that can conceivably be of aid in identifying it. I am convinced that eventually such a standard must be generally adopted if we are ever to arrive at anything approaching permanence in our systematic work. It does not accord with our modern conceptions of efficiency that the enormous volume of work involved in our systematic biology must be done over and over again as our standards change. I see no reason why it should not be possible to arrive once and for all at a standard that will endure. It is perfectly possible for a worker of the present day to see everything that is to be seen upon the body of an insect and I cannot conceive of any mysterious way in which the workers of periods to come can do anything more.

It must, of course, be recognized that even the most conscientious worker is fallible. Furthermore, the overlooking of the obvious is a trait so common that it is hardly to be hoped that anyone—little less the present writer—will be able to attain positively to such an ideal. This, however, need deter no one from the adoption of such a standard.

In cases where it appears that something of value may be added to the existing descriptions of the adults I shall present notes and figures dealing with these also. References will in general not be given and the student is referred for these to the monograph of Crawford mentioned above.

Psyllopsis fraxinicola (Foerster)

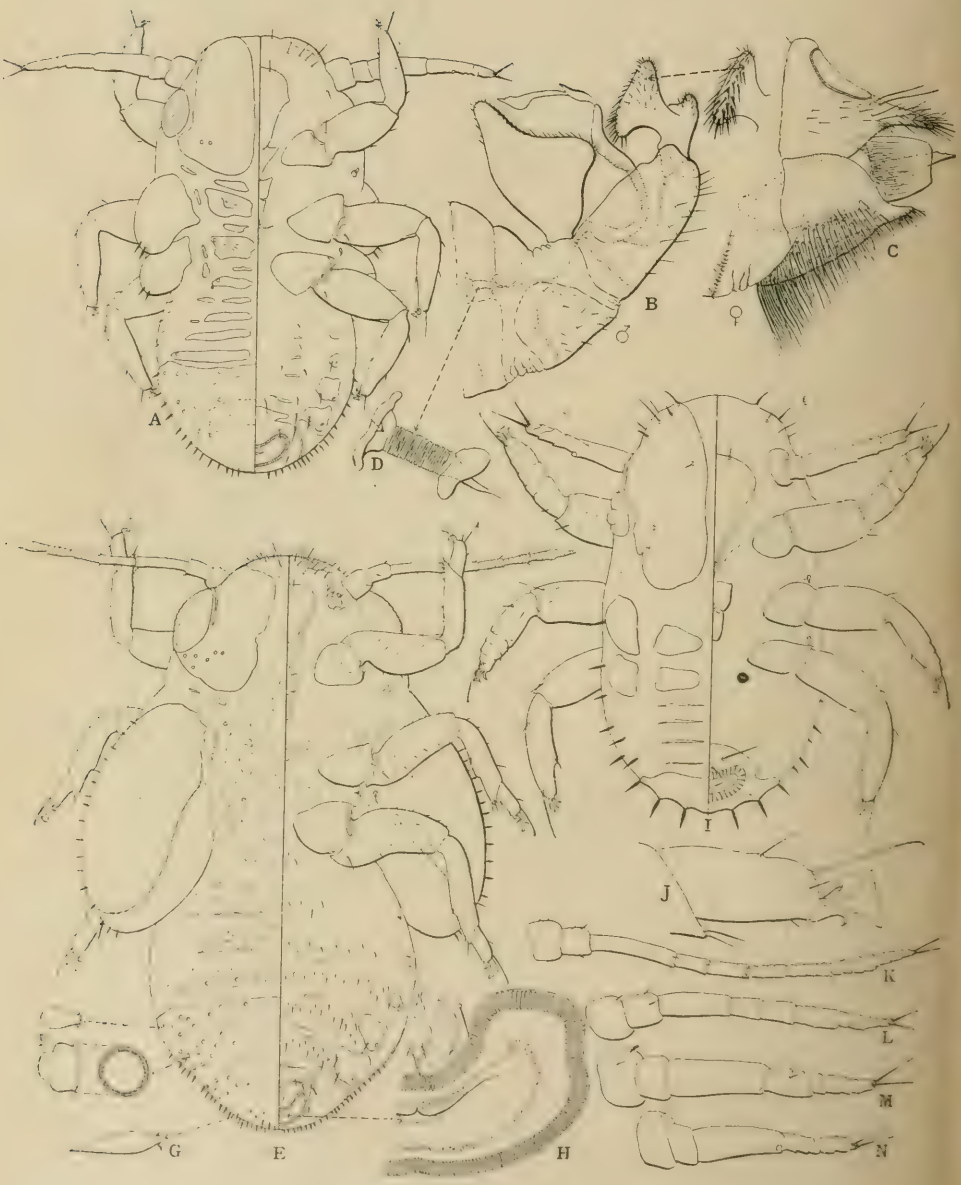
Plate XII.

MATERIAL EXAMINED. Adults and nymphs from "eastern black walnut," Stanford University, Calif., Oct. 13 (C. D. Duncan); nymphs from *Fraxinus dipetala*, North Fork, Madero Co., Calif., May 15 (R. H. Hartman) and from *Fraxinus* sp., Idaho, June 13 (J. C. Evenden).

HABIT. The specimens from walnut at Stanford University occurred on the under side of the leaves. The nymphs were pale green and from the dorsum rose numerous curling threads of wax, these doubtless originating from the large pores which are a characteristic feature of the species. Individuals which had remained in one place for some time were entirely covered by these threads. The posterior end of the body bore a projecting, flattened cylindrical lump of white wax which was readily detachable. This evidently rose from the pore ring surrounding the anus.

ADULT. The description and figures given by Crawford omit certain details of value. In the female the ventral valve of the ovipositor (Plate XII, fig. *C*) bears an area of light colored setae which is very conspicuous, but which is not referred to in the description. I have seen nothing similar to this in any other

CAN. ENT. PLATE 12.



OBSERVATIONS ON THE CHERMIDAE.

species yet examined.

The genitalia of the male are rather inadequately figured by Crawford. The forceps (Pl. XII, fig. *B*) are beset on their outer face merely by fine setae, but on the inner face there are numerous stout setae. The anal valve likewise bears on its inner face at the posterior apex numerous small, cephalically pointing setae.

I wish here to call attention to a structure that is not referred to in any of the descriptions that I have seen, but which appears to have some systematic value. This is an expansion of the anterior extremity of the spermatic duct (Pl. XII, fig. *D*) in the male. In this species it is short and spool-shaped, the ends with a heavily chitinized flange, the median portion transversely striate.

NYMPHAL STAGES. In the material available there are very evidently five nymphal stages. As this agrees with the number found in *Euphyllura arbuti*[2] I have no doubt that this is all there are.

Fifth stage (Pl. XII, fig. *E*). Length 2 mm. Elongate; the wing pads large and projecting well beyond the contour of the body, not produced anteriorly. Derm membranous over the greater part of the body.

Antennae (Pl. XII, fig. *K*) slender, slightly less than half as long as the body, eight-segmented, the last three segments slightly imbricate. Legs without trochanter; with the joint between tibia and tarsus well defined, the tarsus about a third as long as the tibia and bearing a large pulvillus (Pl. XII, fig. *J*) which consists of a slender stalk with a fish-tail shaped expansion distally.

Dorsum with a pair of large, chitinized areas between the eyes; with several very small plates on the thorax which are arranged as indicated; with four very small plates on each of the first two abdominal segments and two larger plates on the next two; with the apical third, including apparently the last three segments, consisting of a single heavily chitinized plate. This plate bears a number of conspicuous pores or pore prominences of the type indicated in Pl. XII, fig. *F* and a few smaller structures having the appearance of short, clavate setae, shown in the same figure. The large cephalic plates each bear five or six of these large pores and there are two or three of them on the thorax and two on each plate of the fourth abdominal segment. The margin of the apical plate and of the wing pads likewise is beset with short, lanceolate setae (Pl. XII, fig. *G*) in an irregular single row and the dorsum bears numerous very minute setae of the same type.

Ventral side with a cluster of slender setae between the bases of the antennae and with a small plate near the base of each antenna. Abdomen with a plate surrounding the anus; with a small plate around each of the last four spiracles; with three pairs of small submedian plates. Each segment with a transverse series of small, slender setae. Anal opening enclosed within a pore ring (Pl. XII, fig. *H*) composed of a single row of slit-like pores. Within this ring there is also another ring of small circular or irregular pores.

Fourth stage. In general character very similar to the fifth but with the dorsal plates of the thorax and the first four abdominal segments larger; with no division between the tibia and tarsus; with the antennae (Pl. XII, fig. *L*) six-segmented and relatively stouter.

2—Ferris, G. F. and Hyatt, Persis. The Life History of Euphyllura arbuti Schwarz. Can. Ent. 55: 88-92. 1923.

Third stage (Pl. XII, fig. *A*). With the general characters of the fourth stage, but with the eyes few-facetted; with the antennae (Pl. XII, fig. *M*) four segmented and relatively stout. Wing pads small, but distinct and free at the tips, the tips bearing merely two or three lanceolate setae.

Second stage. Very similar to the third but with the antennae three-segmented (Pl. XII, fig. *N*). Wing pads smaller and bearing but a single seta at the apex. Apical plate of the dorsum with but four lanceolate setae on each side and with but three pores.

First stage (Pl. XII, fig. *O*). Antennae as in the second stage. Dorsal plates as indicated in the figure, there being but two large thoracic plates in addition to the rudiments of the wing pads. Margin of the apical plate with but three lanceolate setae, this plate occupying but the extreme apex. Margin of the abdomen cephalad of the apical plate with five or six lanceolate setae. Pores entirely lacking. Ventral side with but the terminal plate surrounding the anus, this bearing the pore ring as in the other stages, but with the pores few.

Note: This species is the type of the genus.

Ceropsylla sideroxyli Riley.

MATERIAL EXAMINED. A single adult male and nymphs from *Sideroxylon masticodendron*, Arch Creek, Florida, Mar. 16, 1923. These specimens were received through the kindness of Mr. G. B. Merrill.

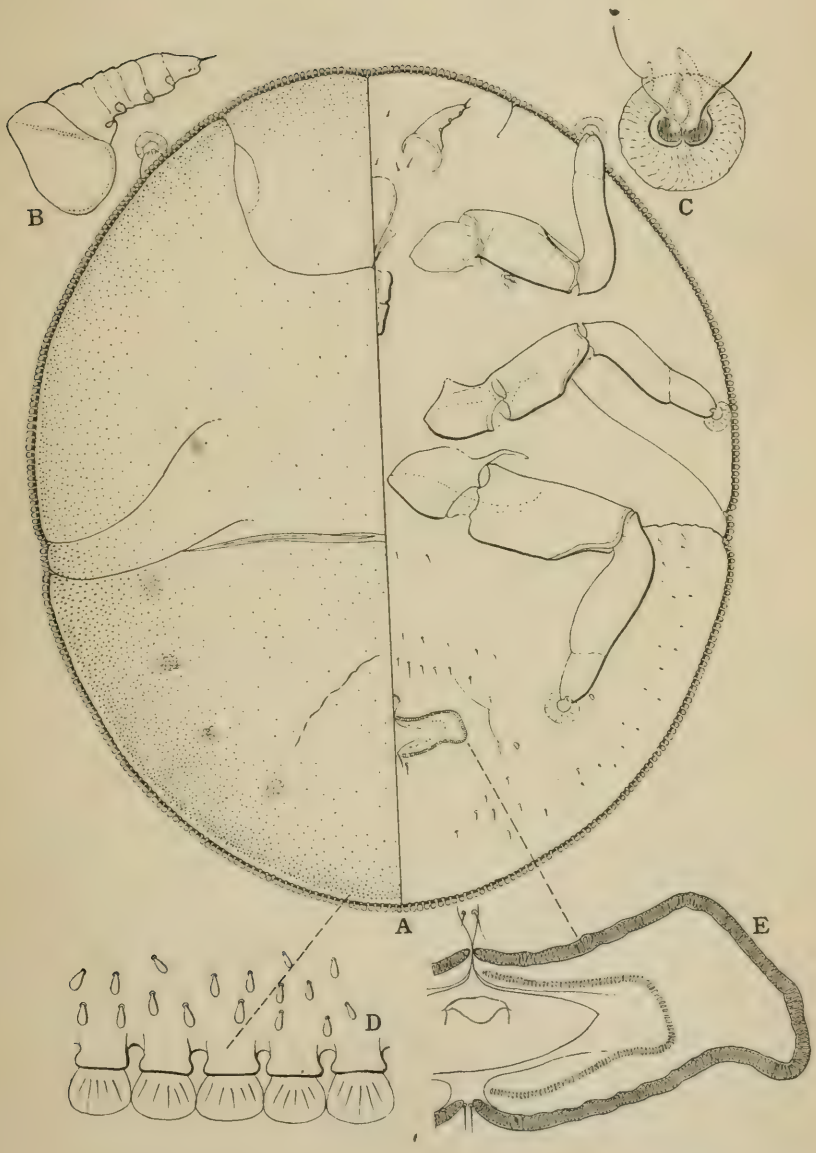
HABIT. Occurring in pit galls on the under side of the leaf, these galls showing as roughened elevations on the upper side. The insects are covered with a copious secretion of white wax, which makes them very conspicuous.

ADULT. There are certain discrepancies between the descriptions given by Crawford and my specimen, but in the absence of the female I leave any notes on the adults until both sexes are available.

NYMPHAL STAGES. My material contains specimens of but three stages, the last, next to the last and the first. Assuming that the same number of stages are found in this as in other species these will be the fifth, fourth and first.

Fifth stage (Fig. 1 *A*). Length 2.5 mm. Form very broadly oval, almost circular. Dorsum heavily chitinized except for the joint between thorax and abdomen. Wing pads not projecting beyond the contour of the body, produced cephalad beyond the eyes. Entire margin of the body beset with a continuous fringe of structures for which no other term than setae seems to be available, these broad and flattened and borne on low prominences (Fig. 1 *D*). The dorsum for a short distance back from the margin is thickly beset with small, clavate setae, these giving way to minutes pores which are distributed over the entire dorsum.

Ventral side apparently membranous throughout. Antennae (Fig. 1 *B*) very short, the segmentation obscure; apparently there are seven segments. Legs scarcely reaching to the margin of the body; with the femora attached to the coxae in a peculiar maner which I have not been able entirely to decipher from my specimens; without trochanter; with the division between tibia and tarsus very obscure or even lacking. Tarsi without claws, the pulvillus of a very peculiar shape, being in the form of a circular pad (Fig. 1 *C*). Anal opening set well away from the apex of the abdomen, surrounded by a pore ring consisting of a single row of slit-like pores (Fig. 1 *E*), this ring interrupted medially



OBSERVATIONS ON THE CHERMIDAE

Fig. 1. Ceropsylla sideroxyli Riley. A.- nymph of last stage; B.-antenna; C.- pulvillus; D.- marginal fringe and modified setae of dorsum; E.- pore rings and structures about the anus.

both anteriorly and posteriorly. Within this ring is another of similar character but with the pores small and somewhat indistinct.

Fourth stage. In general identical with the fifth except for smaller size and relatively larger and fewer marginal setae and fewer clavate setae on the dorsum.

First Stage. Of this but a single specimen is available and this is badly attacked by fungus. As far as may be determined it possesses a complete marginal fringe as in the adult, is heavily chitinized throughout, lacks the clavate setae of the dorsum and has the antennae very short, apparently two-segmented. The pulvilli are as in the fifth stage.

Note: This species is the type of the genus. I have at hand nymphs of a species from *Ficus palmeri* at El Triunfo, Lower California, which probably belongs to this genus. They likewise produce pit galls on the leaves but are not covered with wax. In the absence of adults I am not describing this.

EXPLANATION OF PLATE.

Psyllopsis fraxinicola (Foerster). A.—third stage; B.—genitalia of adult male; C.—ovipositor of female; D.—expansion of the spermatic duct of the adult male; E.—fifth stage; F.—types of pores and modified setae; G.—marginal seta; H.—pore ring and structures about the anus; I.—first stage; J.—tarsus of nymph, fifth stage; K.—antenna of fifth stage; L.—antenna of fourth stage; M.—antenna of third stage; N.—antenna of second or first stage.

NOTES ON THE FEEDING HABITS OF AN ADULT SAWFLY

BY W. G. GARLICK,
University of Kansas, Lawrence, Kans.

The adults of an elm sawfly, *Macroxyela ferruginea* (Say), were particularly abundant in this locality for about three weeks during the present spring and especially so during the week of April 10th to 17th. They were found feeding on the buds of American elm and to a lesser extent on the buds of pear and plum. It is likely that this list of buds eaten could be extended by further observation, though in the examples cited there was a marked preference for elm, which is the food of the larvae. In the case of the elm the buds attacked had grown in length but the leaves had hardly begun to show beyond the tips of the bud scales. In feeding the insect usually began by gnawing a hole in the side of the bud about two-thirds up from the base. With the serrated mandibles a hole was made in the outer covering, frequently much of the material being dropped in the process. As soon as the middle of the bud was reached the insect ate only the central part, working downwards and enlarging the opening as necessary. It was a common sight to see one on a bud with the thorax and abdomen visible but the head completely hidden except for the tips of the backward-bent antennae. If undisturbed the insect often left the bud a mere empty shell, or so badly injured that no further growth took place. Quite frequently there would be sharp encounters for the possession of a bud, the new arrival usually succeeding in ousting out the original possessor—the one that had taken the trouble to pierce the bud. The insects seemed to be ravenously hungry and continued their feeding after the methodical manner of leaf-feeding larvae. With plum and pear the blossom buds were preferred to the leaf buds and some trees suffered somewhat from this injury, though the total damage done was not great.

Both sexes probably feed, though only one male was actually observed feeding. From over two hundred netted specimens the sex ratio ran about five females to one male. Adults were seen feeding throughout the period in which they were at all numerous. The first adult was taken on March 30th and the last on April 24th.

The determination of this sawfly was verified for the writer through the kindness of Mr. Rohwer.

The writer knows of no record of adult sawflies feeding in a wholesale way as described above. Rohwer[1] has recorded a individual of *Tenthredella lineata* (Prov.) devouring an adult Perlid and in the same article notes *Tenthredo arcuatus* (Foerster) eating four stamens of Umbellifer. He also refers to the fact that Morley[2] mentions a female of the latter species as having been seen masticating a female of *Empria pennipes*, so that this sawfly seems to be both carnivorous and herbivorous. Miss Chawner[3] in a note on the feeding habits of sawflies speaks of *Allantus arcuatus* killing and eating small insects. This is probably the species mentioned by Rohwer above. The other diets named by Miss Chawner are pollen of various flowers and the leaves of ash, the latter in the case of *Macrophya punctum-album* only. Venables[4] reports an adult eating Diptera. Peacock[5] states that certain species in his breeding experiments would not oviposit unless supplied with sugar syrup.

Further observations on the life history of *Macroxyela ferruginea* (Say) will be given later.

NEW SPECIES OF NORTH AMERICAN PLECOPTERA

BY P. W. CLAASSEN,
Cornell University, Ithaca, N. Y.

Leuctra bradleyi sp. nov.

Plate XIII, Fig. 1.

Length to tip of wings, male, 6 mm.; expanse 10.5 mm.

General color brown. Head brown, wider than prothorax, feebly pilose; hind ocelli about two diameters distant from eyes. Prothorax hardly wider than long, brown; front angles quite broadly rounded, hind angles sharp; slightly narrowed behind; median longitudinal prothoracic field one-fourth the width of pronotum; discs somewhat rugose. Legs brown. Wings reddish fumose; two cubital crossveins beyond m-cu crossveins.

Genitalia. Male. Abdominal tergites unmodified except ten, which is partly cleft, each side being triangularly produced posteriorly; supraanal lobe triangular, bearing at the tip a slender, re-curved, whip-like process; cerci modified into chitinous armed processes, bulbous at the base and bearing at the tip, as well as below, a sharp tooth; subanal lobes greatly modified into a probe, each lobe receding into segment nine, where the two lobes unite into a long, slender, posteriorly produced, up-curved probe bearing at the tip a bulbous membranous enlargement; titillators absent; ninth sternite produced into a subgenital

1—Proc. Ent. Soc. Wash. XV. pp. 148-149. 1913.
2—Entomologist, London, XLVI, p. 48, Feb. 1913.
3—Ent. Month. Mag. London, p. 19. 1921.
4—Can. Ent. XLVI. p. 121. 1914.
5—Entomologist, London, pp. 227-231. 1922.

plate which is medially deeply and broadly notched; ventral lobe large, hairy, and half again as long as wide.

Female. Unknown.

Holotype: male, July 4, 1908, Emerald Lake, Canadian Rockies, J. C. Bradley, Cornell University Collection.

Leuctra biloba sp. nov.

Plate XIII, figs. 2 and 3.

Length to tip of wings: male, 7 mm; female, 8.5 mm.; expanse: male, 12 mm.; female, 14.5 mm.

General color blackish brown. Head wider than prothorax, blackish, closely covered with fine pile; hind ocelli between two and three diameters distant from eyes. Prothorax dark brown, a little narrowed behind (male); wider than long; front angles broadly rounded, hind angles rather sharp; median longitudinal prothoracic field at least one fifth the width of pronotum; discs only slightly rugose. Legs brown. Wings dusky fumose; 2-4 cubital crossveins beyond m-cu crossveins.

Genitalia: *Male.* From the anterior margin of the eighth tergite there projects backward a raised bilobed chitinous process, the lobes of which are truncate; from the tenth tergite projecting forward a bilobed chitinous process whose lobes are evenly rounded; supraanal lobe broadly rounded; cerci unmodified; subanal lobes broadly elongate; titillators slender, a little shorter than subanal lobes; ninth sternite somewhat produced, not heavily chitinized; ventral lobe half again as long as wide, bearing long hairs.

Female. Eighth abdominal sternite produced into a bilobed subgenital plate with a shallow, triangular median notch.

Holotype, male; *allotype*, female; May 20-25, '11, Black Rock Mt., Rabun Co., Ga., Cornell University Collection.

Paratype: 1 male, same locality.

Leuctra carolinensis sp. nov.

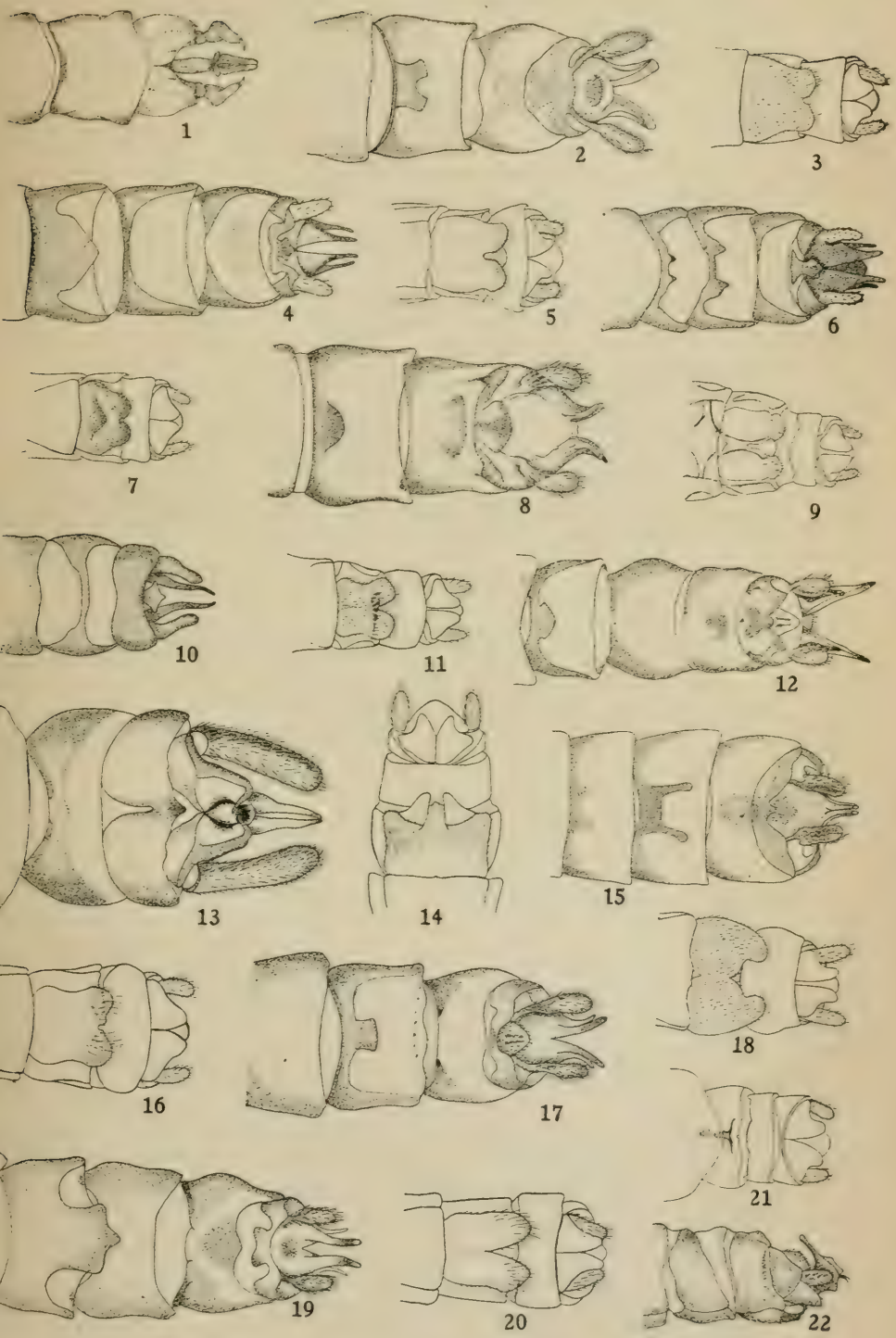
Plate XIII, figs. 4 and 5.

Length to tip of wing: male, 8.5 mm., female, 9 mm.; expanse: male, 15 mm., female, 15.5 mm.

General color dark brown or blackish. Head blackish brown, wider than prothorax; hind ocelli about two diameters distant from eyes. Prothorax dark brown, the rugosities blackish; wider than long, not narrowed behind; front angles rounded, hind angles sharp; median longitudinal prothoracic field between one-quarter and one-fifth the width of the pronotum; discs quite rugose. Legs brown. Wings dark fumose.

Genitalia: *Male.* Seventh abdominal tergite bearing a broad, triangular, spatulate, raised, chitinous process reaching entirely across the seventh tergite; supraanal lobe triangular, short, hairy; cerci unmodified; subanal lobes quite broad; titillators about as long as subanal lobes, broad at base but beyond very slender and curved; ninth sternite slightly produced backward; ventral lobe small, wider than long, hairy.

Female. Eighth abdominal sternite produced into a bilobed, widely emarginate subgenital plate, reaching at least half way across the ninth sternite; the lobes of the plate bear long hairs.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Holotype, male; *allotype,* female; June, 1912, Black Mts., N. C., Beutenmuller, Cornell University Collection.

Paratypes: Males and females from same locality as the type.

Leuctra duplicata sp. nov.

Plate XIII, figs. 6 and 7.

Length to tip of wings: male, 7 mm., female, 8—8.5 mm.; expanse: male, 12 mm., female, 14.5 mm.

General color blackish brown. Head wider than prothorax, blackish, covered with pile; occiput somewhat rugose; hind ocelli between two and three diameters distant from eyes. Prothorax dark brown, wider than long; median longitudinal prothoracic field about one-quarter the width of pronotum; lateral discs somewhat rugose. Legs blackish brown. Wings blackish infuscated.

Genitalia: *Male.* Seventh and eighth abdominal tergites each with a narrow chitinous collar on the anterior margin, each of these collars bearing two short, triangular, chitinous processes; supraanal lobe somewhat triangular; cerci unmodified; subanal lobes broad, angulately upcurved; titillators slender, as long as subanal lobes; ventral lobe longer than wide, bearing long hair.

Female. Eighth abdominal sternite produced into a bilobed subgenital plate, notched in the middle, the lobes rounded, and before the notch a rounded raised tubercle.

Holotype, male; *allotype,* female; June 25, 1922, Labrador Lake, N. Y., C. R. Crosby, Cornell University Collection.

Paratypes: 2 males, 5 females, June 25, 1922, Labrador Lake, N.Y., C. R. Crosby; 1 male, 1 female, July 11, 1905, Brookline, Mass., C. W. Johnson; 1 male, June 12-22, 1901, Adron Mts., Axton, N.Y., A. D. MacGillivray and C. O. Houghton, 1 male, June 8-10, 1915, Chipmunk Swamp, Vandalia, N.Y.; 1 male, June 11, 1909, Woolworth Lake, Fulton Co., N.Y.; 2 females, May 27, 1919, Ringwood Hollow, Ithaca, N. Y.

Leuctra decepta sp nov.

Plate XIII, figs. 8 and 9.

Length to tip of wings: male, 7 mm., female, 8.5 mm.; expanse: male, 11 mm., female, 14 mm.

General color brown to blackish. Head wider than prothorax, blackish, occiput finely granulate; hind ocelli between 3 and 4 diameters distant from eyes. Prothorax brown, wider than long; front angles broadly rounded, hind angles rather sharp; median longitudinal prothoracic field a little less than one-fourth the width of pronotum; lateral pronotal discs quite rugose. Legs brown, wings dusky.

Genitalia: *Male.* Eighth abdominal tergite with a narrow anterior chitinized collar medially produced into a short, rounded knob which is not raised or very slightly so; anterior margin of seventh tergite sometimes with a suggestion of a smaller but similar chitinized area as eighth; supraanal lobe broadly rounded; cerci unmodified; subanal lobes quite slender and considerably longer than the titillators; ventral lobe a little longer than wide.

There seems to be considerable variation in the extent to which the chitinizations on the abdominal tergites of the males have developed in this species.

Female. Eighth abdominal sternite produced into a broadly and deeply notched, bilobed subgenital plate, bearing long hairs and reaching nearly half way across the ninth sternite.

Holotype, male; *allotype*, female; June 29, 1922, Ringwood Hollow, Ithaca, N. Y., Cornell University Collection.

Paratypes: 2 males, 5 females, same locality as types; 1 male, June 7, 1905, Old Forge, N. Y.

Leuctra glabra sp. nov.

Plate XIII, fig. 10.

Length to tip of wings: male, 6 mm. Expanse: male, 10.5 mm.

General color reddish brown. Head brown, wider than prothorax, covered with rather long pile; hind ocelli at least twice as close to eyes as to each other. Prothorax not narrowed behind, wider than long; front angles very broadly rounded; hind angles sharp; median longitudinal prothoracic field about one-quarter the width of pronotum; discs of pronotum slightly rugose. Legs brown. Wings rusty fumose; two to three cubital crossveins beyond m-cu crossveins.

Genitalia: *Male.* Tergites of abdomen unmodified except nine in which the chitinized portion is reduced to a narrow, transverse band; supraanal lobe triangular; cerci unmodified; subanal lobes modified into long, slender upcurved processes; titillators absent; ninth sternite not much produced posteriorly; ventral lobe absent.

Female: unknown.

Holotype: male, Nov. 15, 1899, Jannalpais, Calif., L. O. Howard. In the National Museum, Washington, D. C.

Leuctra hamula sp. nov.

Plate XIII, figs. 11 and 12.

Length to tip of wings: male, 7.5 mm., female, 9 mm. Expanse: male, 14 mm.; female, 15 mm.

General color brown to dark brown. Head wider than prothorax, dark brown or blackish; hind ocelli about two diameters distant from the eyes. Prothorax dark brown, wider than long, narrowed behind; front angles rounded, hind angles sharp; median longitudinal prothoracic field about one-fourth the width of pronotum; discs of pronotum quite rugose. Legs dark brown, wings lightly fumose.

Genitalia: *Male.* Seventh abdominal tergite bearing a medium sized, short, raised, spatulate process which does not extend to the middle of the seventh tergite; supraanal lobe rounded behind; cerci unmodified; subanal lobes quite broad; titillators about as long as subanal lobes, at the tip sharply recurved; ventral lobe about as wide as long.

Female. Eighth abdominal sternite produced into a bilobed, widely notched, subgenital plate which reaches half across the ninth sternite; the lobes are truncate and bear long hairs; median field of seventh and eighth sternite blackish.

Holotype, male; *allotype*, female; July, 1905, Old Forge, N. Y., Cornell University Collection.

Paratypes: 5 males, 2 females, June 24, 1905, Old Forge, N. Y.; 1 male, 1 female, 6-23-10, Woolworth Lake, Fulton Co., N. Y.; 1 male, Sacandaga Park, N. Y., E. P. Felt; 1 male, 1 female, Aug. 16, Mt. Marcy, Keene Valley, N. Y.; 1 male, 6 females, Aug., 1912, Mt. Kathadin, Me.

Leuctra infuscata sp. nov.

Plate XIII, figs. 13 and 14.

Length to tip of wings: male, 7 mm., female, 9 mm.; expanse: male, 11 mm., female, 15 mm.

General color dark brown. Head wider than prothorax, nearly smooth; hind ocelli about twice as close to eyes as to each other. Prothorax dark brown, narrowed behind, wider than long, median longitudinal prothoracic field between one-third and one-quarter as wide as pronotum; discs of pronotum somewhat rugose, the rugosities blackish. Legs dark brown. Wings infuscated; Sc_2 bends down to R, not at a sharp angle, but more or less with a gradual curve; 2-3 cubital crossveins beyond m-cu crossveins.

Genitalia. Male. Tergites of abdominal segments unmodified; supra-anal lobe produced into a short, bulbous process which is excavated above and on the lateral upper margins with a narrow, chitinous band closely beset with long hairs, cerci membranous, very large, about four times as long as wide; subanal lobes produced into long sword-like processes, abruptly drawn to a slender rod before the tip and near the tip bearing below a recurved spine; titillators curved down and then up again, slender, heavily chitinized; ventral lobe very short, hairy, much wider than long.

Female. Eighth abdominal sternite produced into a subgenital plate, which is medially somewhat raised into a hairy ridge, notched in middle, the notch produced by the projection of a triangular, heavily chitinized plate on each side.

Holotype: male, 3-15-98, Seattle, Washington, Cornell University Collection.

Allotype: female, 4-28-98, Seattle, Washington.

Paratypes: 1 female, 4-14-99, Seattle, Washington; 3 females, June 6, 1920, Shasta Springs, Calif., C. L. Fox; 1 female, 6-10-21, Yosemite Valley, Calif., E. C. Van Dyke.

Leuctra sibleyi sp. nov.

Plate XIII, figs. 15 and 16.

Length to tip of wings: male, 8.5-9.5 mm., female, 9.5-11 mm. Expanse: male, 14.5-15.5 mm., female, 16-20 mm.

General color brown. Head wider than prothorax; occiput somewhat rugose and mottled with darker brown; hind ocelli between two and three diameters distant from eyes. Prothorax wider than long, brown; angles broadly rounded; median longitudinal prothoracic field at least one-fifth the width of pronotum; discs of pronotum quite rugose, the rugosities darker. Legs brown. Wings subhyaline to brownish infuscated.

Genitalia: *Male.* Anterior margin of eighth tergite heavily chitinized and bearing two long, slender, widely separated, raised chitinous processes which reach over the entire eighth tergite; supraanal lobe rounded behind; cerci unmodi-

fied; subanal lobes quite long and slender; titillators slender, nearly straight, shorter than subanal lobes; ventral lobe at least twice as long as wide.

Female. Eighth abdominal sternite somewhat produced into a bilobed hairy subgenital plate with a small median notch.

Holotype, male; *allotype*, female; May 16, 1922, Moore's Brook, Ithaca, N. Y., C. K. Sibley, Cornell University Collection.

Paratypes: 5 males, 10 females, May 16, 1922, Moore's Brook, Ithaca, N. Y.; 3 males, 1 female, May 15, 1915, Taughanic, Ithaca, N. Y.

Leuctra triloba sp. nov.

Plate XIII, figs. 19 and 20.

Length to tip of wings: male, 6.5 mm., female, 8 mm. Expanse: male, 11 mm., female, 14 mm.

General color dark brown. Head wider than prothorax, brown; hind ocelli between two and three diameters distant from eyes. Prothorax brown, considerably wider than long; front angles somewhat rounded, hind angles sharp; median longitudinal prothoracic field at least one-quarter the width of pronotum; lateral discs somewhat rugose. Legs brown. Wings uniformly reddish fumose.

Genitalia: *Male.* Seventh abdominal tergite with a large, raised, more or less trilobed, chitinous process which reaches well unto the eighth unarmed tergite; supraanal lobe short, rounded; cerci small, unmodified; subanal lobes quite broad and apically very finely spinulate; titillators slender and shorter than subanal lobes; ventral lobe about as broad as long.

Female. Eighth abdominal sternite produced into a bilobed, hairy, subgenital plate which is rather narrowly notched in the middle.

Holotype, male; *allotype*, female; Sept. 14, 1899, McLean, N. Y., Jensen, Cornell University Collection.

Paratypes: A number of males and females from the same locality.

Leuctra truncata sp. nov.

Plate XIII, figs. 17 and 18.

Length to tip of wings: male, 7 mm., female, 8-9 mm. Expanse: male, 12.5 mm., female, 15-17 mm.

General color brown. Head wider than prothorax, uniformly brown, occiput slightly rugose; hind ocelli between two and three diameters distant from eyes. Prothorax brown, a little wider than long., slightly narrowed behind; median longitudinal prothoracic field about one-quarter the width of pronotum; lateral discs moderately rugose. Legs brown, wings subhyaline.

Genitalia: *Male.* Seventh abdominal tergite smooth; eighth tergite bearing, near the anterior margin, a short, median, raised, truncate, chitinous projection, about as wide as long; supraanal lobe short, triangular; cerci unmodified; subanal lobes quite slender; titillators considerably shorter than subanal lobes; ventral lobe very little longer than wide.

Female. Eighth abdominal sternite slightly produced into a broadly notched bilobed subgenital plate, the lobes rounded and bearing long hairs.

Holotype, male; *allotype*, female; Aug. 9, 1905, Old Forge, N. Y., Cornell University Collection.

Paratypes: Many males and females from same locality.

(To be continued)

NOTES ON THE EGANS GROUP OF OLIGIA (PHALÆNIDÆ, LEPID.)

BY WM. BARNES AND F. H. BENJAMIN,

Decatur, Ill.

Oligia violacea Grote

1881. Grote, Bull. Geol Surv. Terr., VI, 261, *Hadena.*
1893. Smith, Bull. U. S. N. M., XLIV, 141, *Hadena.*
1903. Holland, Moth Book, p. 167, pl. XX, f, 12, *Hadena.*
1908. Hampson, Cat. Lep. Phal. B. M., VII, 375, pl. CXVII, f, 22, *Oligia.*

A somewhat variable species in color and brightness of pattern, the secondaries sometimes slightly tinged with fuscous but presenting a decidedly white ground color. The figures listed above will serve to identify the species, which is represented in the Barnes collection by specimens from Truckee, Mission San Jose, Nellie, and Plumas Co., Calif.; Pullman, Wash., Glenwood Springs, Silverton, and "Oak Creek Canyon," Colo.; Yellowstone National Park; and Eureka, Utah.

Oligia violacea race rampartensis nov. var.

Similar to *violacea* in size and markings, but so much darker in color that it was confused with *ferrealis* in the Barnes collection, the violaceous tints almost obscured. Orbicular and reniform somewhat smaller than normal for *violacea*, thus approaching *bridghamii*. Secondaries strongly tinged with fuscous.

The present subspecies may possibly be entitled to specific rank as there are several minor genitalic differences between it and *violacea*. Both agree, however, in possessing in the ædeagus, besides other armature, a strongly chitinized plate bearing only four teeth.

Type locality: Ramparts, Alaska.

Number and sexes of types: Holotype ♂, Aug. 1-7.

Oligia egens Walker

1856. Walker, Cat. Lep. Het. B. M., X 263, *Celaena.*
1882. Grote, Ill. Essay, p. 45, (on type), *Celaena.*
1889. Butler, Trans. Ent. Soc. Lond., p. 386 (*ferrea,*) *Mamestra.*
1891. Smith, Proc. U. S. N. M. XIV, 251, *Mamestra.*
1893. Smith, Bull. U. S. N. M., XLIV, 144, (on type), *Hadena.*
1908. Hampson, Cat. Lep. Phal. B. M., VII, 377, pl. CXVII, f. 24, *Oligia.*

race *ferrealis* Grote

1883. Grote, Can. Ent., XV, 29, *Mamestra.*
1891. Smith, Proc. U. S. N. M., XIV, 269 ignot., *Mamestra.*
1893. Smith, Bull. U. S. N. M., XLIV, 128, ignot., *Mamestra.*
1905. Hampson Cat Lep. Phal. B. M., V, 177, ignot., *Polia.*

syn. *transfrons* Neumoegen

1883. Neumoegen, Papilio, III, 139, *Hadena.*
1893. Smith, Bull. U. S. N. M.,XLIV, 141, *Hadena.*
1903. Holland, Moth Book, p. 166, pl. XX, f. 7, *Hadena.*
1908. Hampson, Cat. Lep Phal. B. M., VII, 377, *egans* (partim.) *Oligia.*

race *bridghamii* Grote and Robinson

1866. Grote and Robinson, Proc. Ent. Soc. Phila., VI, 17, pl. III, f. 1, *Mamestra.*
1873. Grote, Bull. Buff. Soc. Nat. Sci., I, 108, (*bridghami*), *Hadena.*
1893. Smith, Bull. U S. N. M., XLIV, 141, (*bridghami*), *Hadena.*
1903. Holland, Moth Book p 166, pl. XX, f. 2, (*bridghami*), *Hadena.*
1908. Hampson, Cat. Lep. Phal. B. M., VIII, 376, (*bridghami* partim.), *Oligia.*

form *iridis* Dyar

1908. Hampson Cat Lep. Phal B. M., VIII, 376, pl. CXVII, f. 23 as *bridghami* (for *bridghamii*), partim., *Oligia.*
1923. Dyar, Ins. Insc. Menst., XI, 17. *Oligia.*

The type of *O. egens* must be re-examined by someone possessing considerable material in the group. If it is the same as the Colorado specimen men-

tioned by Smith (1883), it is probably a race distinct from *ferrealis* (*transfrons*). The type came from the vicinity of Hudson Bay, so that it may be the same as *ferrealis* (see Hampson, 1908, who lists *transfrons* synonymous); or it may be the same as *iridis*; forms belonging to the Hudsonian Faunal Zone sometimes extending southward into New England and New York, sometimes extending westward through Manitoba and Alberta. *Bridghamii*, usually spelled *bridgiami*, is apparently the eastern representative of *egens*. The figures of Grote (1866) and Holland (1903) represent true *bridghamii*. Hampson's figure (1908) seems referable to *iridis*. A specimen compared with Dr. Dyar's types of *iridis* shows this name to represent a form of *bridghamii* with dark secondaries. Judging from Grote's figure, the type of *bridghamii* possesses some fuscous banding on the secondaries, but the fuscous is not as evenly suffused as on the types of *iridis*.

The name *ferrealis*, heretofore listed as an unplaced species of *Polia* or *Mamestra*, must take the place of *transfrons*. The unique type of *ferrealis* is in the Cornell University Collection, and through the kindness of Dr. W. T. M Forbes, the authors have been enabled to compare it with the series of *transfrons* in the Barnes Collection. Both prior and subsequent to comparison with the type of *ferrealis*, specimens have been compared with the type of *transfrons* in the Neumogen Collection. Both names represent the same subspecies, *ferrealis* appearing to have several months' priority. Holland's figure (1903) as *transfrons*, seems good. Hampson's figure (1908), as *egens*, is probably referable to true *egens*, or is poor.

The various subspecies of *O. egens* possess very similar genitalia, and although there is some variation in the shape of the harpes and the uncus it appears to be purely individual, the genitalia of specimens of the same form from the same locality varying, while the genitalia of some specimens representing each subspecies appear practically identical. All agree in possessing in the aedeagus, besides other armature, a strongly chitinized plate armed with a number of small teeth, thus differing from *violacea*, which possesses a similar plate armed with only four larger teeth.

NOTES ON TWO MOSQUITOES FROM BRITISH COLUMBIA (CULICIDAE, DIPTERA)*

BY ERIC HEARLE,
Banff, Alta.

Aedes mutatus Dyar.

In the Canadian Entomologist for January, 1923, the writer proposed the name *Aedes hewitti* for some small ring-legged *Aedes* of the *stimulans* group that he took in the Fraser Canyon at Yale, B. C., in 1919 and 1920. Although the specimens very obviously came close to *Aedes mutatus* Dyar and *Aedes increpitus* Dyar, the male hypopygium showed sufficient difference from the published descriptions of either of these to warrant the proposal of a separate name.

Unfortunately, it appears that in describing the male genitalia of *Aedes mutatus*, Dr. Dyar had before him an abnormal specimen in which the angular expansion of the filament of the claspette was near the base—this position is

*—Contribution from the Entomological Branch, Dept. of Agric., Ottawa, Ont.

given in all of the keys in which reference is made to this species. On page 40 of Insecutor Inscitiae Menstruus for January—March, 1923, Dyar corrects the description and states that in *Aedes mutatus* Dyar the angular expansion of the filament of the claspette occurs almost exactly at the middle. The difference thus disappears and the name *Aedes hewitti* must be relegated to the synonymy of *Aedes mutatus* Dyar. There is no record of this species having been taken previously in Canada. Its habitats appear to be very restricted. Dyar states that it breeds in the little pools in the flood deltas of swift mountain rivers.

Aedes idahoensis Theobald.

This mosquito of the arid valleys has not been recorded previously from Canada, although Dr. Dyar stated that it would probably occur, at least in the Okanagan Valley of British Columbia (Dyar; Mosquitoes of Canada; Trans. Roy. Can. Inst.: Toronto; Vol XIII; Part I, p. 93; 1921.

In the summer of 1920 the writer carried out a very brief survey of mosquito conditions in the Lower Okanagan Valley, B. C.,—a district where arid, somewhat desert like conditions obtain, and where the valley is open except for a thick vegetation in the river bottom and scattered yellow pine and sage-brush. The survey was made too late in the year for much collecting, but a number of *Aedes vexans* Meigen were taken; among these was found a single female specimen of *Aedes idahoensis* Theobald; this was in such good condition that there was little difficulty in determining its identity. The specimen was taken at Lattimer's Camp near Oliver on August 21st, 1920.

STUDIES IN CANADIAN DIPTERA*

II.—The Genera of the Family Blepharoceridae

BY C. HOWARD CURRAN,

Ottawa, Ont.

Bibionus new genus

Eyes contiguous above, the upper two-thirds with enlarged facets; antennae 14 jointed, as long as head. Mesonotum higher than the head, the suture deep, on anterior half, oblique, slightly angulated before its middle and curving as a faint impression around to behind the inner ends of the postalar calli, but the curve is slight and irregular; this leaves an elongate oval, anteriorly pointed false postalar callus, postero-externally of which the postalar calli is rather weakly differentiated. Legs very long and slender, with short, appressed pile, middle tibia with one, the hind with two apical spurs. Wings large, weak posteriorly, the third vein branched just beyond the anterior crossvein, the branch ending in the first twice as far from its tip as the apex of the third vein is beyond it; anterior crossvein half as long as the rectangular base of the anterior branch of the fourth vein; fifth vein roundedly oblique basad of the crossvein joining it with the fourth vein. Abdomen narrow, compressed, of nearly equal width, its venter slightly wider, plane, with parallel sides; genitalia broader and higher than the abdomen, laterally compressed below, placed at right angles, the basal (upper) plate narrow, the apical (ventral) plate evenly convex from base to upper angles. Type, *B. griseus* n. sp.

This insect shows a remarkable superficial resemblance to some species

*—Contribution from Division of Systematic Entomology, Entomological Branch, Dept. of Agric. Ottawa.

of the genera *Rhamphomyia* and *Empis*, but the antennae, eyes, wing venation, thorax, etc., at once distinguish it and there can be no doubt about its position in the Blepharoceridae. The termination of the branch of the third vein is unique, and the branch of the fourth vein ends before the apex of the wing. The most unusual feature, however, is the remarkably large genitalia, but in essentials even this is quite typical.

A careful study of the wings reveals the presence of an incomplete vein between the fourth and fifth longitudinal veins, a character overlooked at first because of the crumpled condition. There are also the numerous folds as in *Blepharocera*. The character which definitely separates this genus from *Bibiocephala* is the apparent point of origin of the second vein.

The following table of genera includes all those of which I am aware in the world and is based upon Dr. Kellogg's table in Genera Insectorum. In couplet 8 it will be noted that reference is made to the second longitudinal vein being unbranched. Actually the second vein is wholly fused with the third and it is only present in *Bibiocephalus* and *Bibionus*.

KEY TO GENERA

1. No incomplete vein between the 4th and 5th longitudinal veins 2
   An incomplete vein between the 4th and 5th longitudinal veins 7
2. Eyes bisected by an unfacetted crossband or line into a dorsal brownish region of larger facets and lower black region of small facets 3
   Eyes not bisected by unfacetted crossband; radial vein branched 4
3. Wings without basal anterior crossvein (no crossveins) (Europe) ..... *Apistomyia* Big.
   Wings with basal anterior crossvein (Ceylon) ..... *Hammatorhina* Lw.
4. Eyes contiguous above or practically so 6
   Eyes separated above antennae 5
5. Proboscis long, palpi but little developed ..... *Paltostoma* Schin.
   Proboscis not longer than the vertical diameter of the head; palpi well developed, four-segmented ..... *Kelloggina* Will.
6. Tibiae with apical spurs; ungues of ordinary structure .... *Corupira* Mull.
   Tibiae without apical spurs; ungues pulvilliform ..... *Hapotothrix* Lw.
7. No crossvein connecting the fourth and fifth veins (posterior basal cell absent) ..... *Blepharocera* Macq.
   A crossvein connects the fourth and fifth veins (posterior basal cell present) 8
8. The second longitudinal vein is not branched ..... *Philorus* Kellogg
   The second longitudinal vein is branched, the branch either simulating a crossvein near the base of the second vein or rising beyond the anterior crossvein, in which case it is long and reaches nearly to the end of the first vein into which it runs 9
9. The branch of the second vein rises beyond the anterior crossvein and joins the costa a short distance before its apex, eyes broadly contiguous ..... *Bibionus* Curran
   The branch of the second vein usually simulates a crossvein in which case it lies entirely before the anterior crossvein, eyes distinctly separated.... *Bibiocephala* O. S.

This family is poorly known in so far as the Canadian fauna is concerned, and only four species, *Bibiocephala canadensis* Garrett, *Philorus aylmeri* Garrett, and *Bibionus griseus* Curran, all from the Rocky Mountain region, and *Blepharocera tenuipes* Walker from Eastern Canada, are recorded.

Bibionus griseus new species

Long, slender, legs very long, abdomen laterally compressed, venter narrow, but wider than the compressed abdomen, perfectly plane; pile wholly black; antennae 14-jointed.

Length, 10 mm. Wing the same. *Male.* Face small, densely silvery greyish pollinose, cheeks similar, occiput thinly greyish yellow pollinose. Frontal triangle small, sunken, thinly grey pollinose, bare; ocellar triangle larger than the frontal, prominent. Antennae moderately long, the first two joints swollen, the first as wide as long, equalling in length the third and fourth combined, second as long as the succeeding three joints combined, narrow basally, as wide as or slightly wider than the first on apical half, both with moderately long, abundant black pile, the remaining joints much more slender, sub-equal in length, thinly black haired, the pile not conspicuous, appressed. Pile of head wholly black, rather stout on face, moderately short on eyes, but with numerous longer hairs scattered throughout, but these are not numerous enough to upset the uniform appearance of the short ones.

Thorax cinereous pollinose, middle line broadly (narrowly interrupted by a longitudinal cinereous middle stripe on anterior half) and a suturally interrupted stripe on either side on the posterior three-fourths, not reaching the hind margin, olive yellow or pale brownish pollinose, the middle stripe broadly separated from the front margin. The pile is rather sparse, not long, black; more abundant on the pleura; longer behind on the mesonotum and extended somewhat forward. Mesonotum narrowly separated from pronotum by the collar, which is, however, not prominent, the humeri prominent, placed slightly obliquely, their greater surface in front. No suture between the scutellum and thorax, the mesonotum merely continuing back on the horizontal plane, after its posterior convexity, but at the sides there is a deep, narrow concavity; at the base of the scutellum on the middle half there is a moderately wide, transverse, almost flat area, beyond which the scutellum becomes slightly convex, the apex with a narrow, median, vertical depression and on either side with five or six faint ones.

Legs slender, very long, the hind femora reaching to the end of the abdomen, the front four almost two-thirds as long; middle tibiae almost as long as their femora, the others about four-fifths as long, tarsi longer than their tibiae; front coxae short, their trochanters as long as middle coxa and trochanter combined. Middle femora slightly curved forward, the front ones strongly curved forward and somewhat upward, the apical fifth straight. Front tibiae with one, the hind with two apical spurs. Coxae, trochanters, basal half to two-thirds of the femora, less so below, yellowish, hind tibia brownish. Coxae more or less fuscous or blackish basally. Hairs of legs wholly short, black. Front basitarsi curved upward; basitarsi of all legs nearly as long as following joints combined.

Wings brownish yellowish. Halteres very long, slender, yellow. Squamae pale yellow, with moderately long black fringe.

Abdomen laterally compressed, very narrow, the venter flat, its margin projecting slightly beyond the dorsal portion, its sides parallel. Ground color black, the sides of the venter luteous, wholly silvery (not white), pollinose, the narrow, dorsal sub-apex of each segment yellow pollinose, the apices darker. Pile black, long basally, but gradually becoming shorter so that on the last three segments it is very short, appressed, and the whole disc bears similar pile. Genitalia reddish, compressed, placed at right angles to abdomen, its apical margin evenly convex, the posterior piece large, widened above so that it is half as wide transversely as its height, the terminal pieces broad, flat, obtuse apically, twice as long as wide, their posterior fourth produced as a rounded lobe, not twice as long as wide; the anterior basal piece is broad, slightly emarginate apically, its corners rounded, its apical piece broadly cleft to the base so that it leaves a narrow, emarginate apical piece on either side, which is over twice as wide as long and longer inwardly. The central cleft is filled with a yellow piece on either side which is triangular from lateral view, its posterior edge longer, its apex slightly excavated. The basal or anterior piece is brown, the superior portion of the posterior piece fuscous. No pile except on the apical lamellae.

Holotype—♂, Nordegg, Alta., June 26, 1921, (J. McDunnough), No. 587, in the Canadian National Collection, Ottawa.

A NEW SYRPHID FROM ONTARIO (DIPTERA)*

BY C. HOWARD CURRAN,

Ottawa, Ont.

Temnostoma nipigonensis n. sp.

Length, 14 to 16 mm.; *Male* and *Female*. Abdominal markings as in *aequale* but the pale bands are greyish and much narrower, the median black bands on the third and fourth segments entire or the last one narrowly interrupted. Suture of the thorax with two yellowish pollinose spots as in *alternans*; pile of the thorax wholly black, that of the abdomen also black except on the lateral margins. Anterior legs black, the posterior four reddish, their femora more ferruginous, rather brown beneath on more than basal half. Wings as in *aequale*, but more heavily infuscated.

Holotype—♂, Macdiarmid, (Lake Nipigon), Ont., June 22, 1923, (N. K. Bigelow), No. 660, in the Canadian National Collection, Ottawa.

Allotype—♀, same data, in Royal Ontario Museum, Toronto.

This species is so very distinct from any described that a complete description seems unnecessary, a comparison with two common species serving better. The almost wholly black pile is very distinct.

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*—Contribution from Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

A NEW SUBSPECIES OF EURYOPHTHALMUS CINCTUS (HEMIPTERA)*

BY EDWARD P. VAN DUZEE,
San Francisco, California.

Euryophthalmus cinctus californicus new subspecies.

Differs from typical *cinctus* H. S., as found in Mexico, in having the head, the pronotum anteriorly and the lower surface clothed with numerous erect stiff black hairs. On the venter these black hairs are frequently intermixed with pale ones and on the pronotum a tendency toward the same variation may appear thus approaching typical *cinctus*. In the typical form of this subspecies as taken about San Francisco the color is largely black; the extreme base of the first antennal segment and its socket, the bucculæ, acetabulæ, coxæ, trochanters, narrow base of femora, apex of osteolar canal, connexivum, hind edge of pronotum and costal margin of elytra are red and often the genital segment is touched with the same color. Usually the elytra are more or less rufotestaceous or ochraceous, closely and coarsely punctured and varied with black, and at times the pale margin of the pronotum is extended down the sides a little way.

Described from numerous specimens taken about San Francisco, California, where it is very abundant on lupines on which the young feed.

Type, male, No. 1303, and allotype, female, No. 1304, Museum California Academy of Sciences, collected on Lone Mountain in the City of San Francisco, July 23, 1916, by the writer.

This subspecies is characteristic of the cool coastal belt of California, but extends its range eastward to the foothills of the Sierra and southward to Palm Springs and San Diego County, where it mingles with more typical *cinctus* and acquires the shorter cinereous pubescence and loses a portion of the black hairs. The typical *cinctus* is common everywhere I have collected in Sonora and Lower California, and on the islands of the Gulf of California, where it feeds upon Laccodesmia and the related acacias. *E. convivus* Stal. is a broader paler form common in Sonora and especially Arizona, and extends its range eastward to the mountains of Texas. It is very close to *cinctus* and like that form wants the stiff black hairs on the head and pronotum. *E. succinctus* Linn. is nearer to *californicus*, having some of the black hairs on the head and pronotum, but has a longer rostrum. It lives in the gulf states from Florida to Texas. *E. varians* Stal. is a narrower paler form from Sinaloa and farther south in Mexico. *E. davisi* Barb., from Florida, is a redder form with more of the pale tomentum. These six forms should undoubtedly be considered as geographical races or subspecies of one species (*succinctus* Linn.) as all intergrade where their distribution overlaps and the first four at least, of which I have examined the males, have the same form of male claspers.

*—Contributions from the California Academy of Sciences, No. 219.

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NEW CYCLORRHAPHOUS DIPTERA FROM CANADA*

BY C. HOWARD CURRAN,
Ottawa, Ont.

Melanostoma fallax n. sp.

Allied to *mellinum* but the face is more shining, the antennae darker and shorter, abdominal spots larger in ♂.

Length 6 to 8 mm. *Male.* Face and front shining black; with very thin yellow pollen; pile short, wholly black; face retreating, tubercle small, oblong, conspicuous. Antennae black, third joint narrowly reddish at base below, not quite twice as long as broad. Arista as long as antennae, rather stout, very short pubescent. Vertical triangle shining black; prominent, black pilose. Eyes touching for moderate distance. Occiput shining black, along the eyes brassy yellow pollinose, wholly yellow pilose.

Thorax brassy black; bright yellow pilose; on the disc chiefly long, black pilose. Scutellum yellow and black haired. Pleura lightly grey pollinose, that on the mesopleura tawny.

Legs reddish; basal half of the front four, and three-fourths of the hind femora, more than the middle half of the hind tibiae and last four joints of their tarsi, black; hind basitarsi brown except the apex. Pile of legs, sparse, yellow.

Wings faintly brownish yellow, darker in front on the middle region. Squamae white with faintly yellow border and fringe. Halteres yellow.

Abdomen reddish yellow; first segment, apex of fourth and the entire side margins brassy black, sometimes more or less bronzed; second segment with a broad, basal band expanded posteriorly in the middle and forming a broad, longitudinal stripe connecting with the rather narrow hind border, opaque black; third segment with a median longitudinal stripe and a moderately narrow posterior band which widens a little laterally; the median stripe is widened in front. Median stripe on fourth segment not so widened anteriorly, the posterior band one-third the length of the segment. Pile yellow; on the opaque black markings beyond the basal half of the second segment, black. Genitalia shining black. First two ventral segments shining black; third and fourth marked as the dorsum, the yellow spots very bright, the median stripe on the first segment brownish or sometimes obsolete.

Female. Front narrowed above; below the middle with a rather narrow, interrupted greyish yellow pollinose band; wholly black pilose. Antennae with the second joint wholly, apex of first and lower half or less of third, reddish.

Thorax wholly pale yellow pilose. Femora wholly reddish, on the hind ones with an obscure brownish pre-apical band. Hind tibiae with a broad median band and the last two joints of their tarsi brown. Wings slightly yellowish. Stigma pale yellow.

Abdomen shining black; elliptical. Spots on second segment a little

*—Contribution from Division of Systematic Entomology, Entomological Branch, Dept. of Agric, Ottawa.

behind the middle, rather large, roundish or rectangularly rounded. Spots on third and fourth segments triangular, their posterior end broadly rounded, the inner side slightly convex, the outer produced narrowly to the side margin; the spots resting on the base of the segment. The spots on the fifth segment are transverse, rounded behind; produced to a point at the lateral margins; all the spots broadly separated medianly, the last pair less so. Venter black, with smaller yellow spots than on the dorsum, in the same relative position; no spots on second segment.

Holotype—♂, Banff, Alta., May 5, 1922, (C. B. D. Garrett), No. 574 in the Canadian National Collection.

Allotype—♀, same data.

Paratypes—34 specimens of both sexes, same locality.

Platychirus nodosus n. sp.

Abdomen reddish with rather narrow, median vitta and posterior segmental margins; front tibiae gradually broadened from the base; base of femora with two (rarely only one) long curved hairs, the apex of each is lamellate or knobbed, hence the name. Belongs to the *quadratus* group.

Length, 7 to 8 mm. *Male.* Face and front shining greenish black, the former, except the lower part of the cheeks, moderately yellowish or greyish yellow pollinose, the ground color sub-obscured in some lights. In profile the face is retreating, the tubercle not conspicuous, but formed by a swelling of the face, so that the upper half of the face is gently concave, and a shallow concavity is formed below the tubercle; epistoma but little prominent. Pile of face rather sparse, stout, black; of the frontal triangle longer and coarser. Front thinly pollinose except just above the antennae; with a brassy or bronzed reflection. Eyes touching for a distance equal to the distance between the anterior and posterior ocelli. Vertical triangle black, swollen; black pilose in front. Occiput thickly greyish or greyish yellow pollinose, with yellowish pile. Antennæ wholly black; third joint almost one and one half times longer than broad. Arista as long as last two antennal joints combined, thickened but gradually tapering on its basal half, although the immediate base is smaller.

Thorax shining black, the dorsum rather brassy or slightly bronzed, the disc just a little dulled and with three or four darker lines in some lights; scutellum shining black. Pile rather tawny, but the ends of the hairs pale.

Legs reddish; bases of anterior four femora yellow; apical third of fore tibiae and base of basitarsi whitish; a streak on the apical half or more of the front four femora behind, but not reaching the apex, and the hind legs entirely except the narrow apices of femora, slightly broader bases of tibiae and their narrow apex, black. Front femora behind, just after the base with two or three long, curved tufts of hair, each so closely placed as to appear as a single stout hair, the apex congealed so as to form a large knob which is usually oval, but varies considerably and is often spindle shaped; all the other hairs on the front femora are fine and sparse, mostly yellowish, but there may be some black ones on the postero-apical half. Front tibia unusually broadened, the broadening commencing at the base, being a little more gradual on posterior side, and with a very shallow, long concavity before the middle anteriorly, its

outer apex produced lappet-like. Front basitarsi about two-thirds as wide as tibiae, one and one-fourth longer than broad, slightly tapering; second joint a little broadened, quadrangular; last three joints normal. Middle femora robust, normal. All the femora with pile as on front ones; tibiae and tarsi all with short, rather sparse, yellow pile.

Wings conspicuously fuscous; stigma luteous. Squamae white with white fringe; halteres yellow.

Abdomen with almost parallel sides; reddish yellow, with the first segment and hypopygium, a broad median vitta slightly wider on the front margin of each segment, noticeably so on the second segment, the apices of each segment less widely than the median vitta and the side margins in about the same width as the median vitta, black, opaque except on hypopygium, sides of segments and basal segment. On the fifth segment there is an apical triangular spot occupying the median half or more and connected with the base by the vitta, the sides not black. Pile yellow, moderately long basally, becoming short apically; on the black apical bands of third and following segments, short, sub-appressed, black. Venter pale yellow, with a broad, longitudinal stripe on the fourth segment, and sometimes a darkening on the two preceding segments.

Female. Quite different, resembling *Melanostoma mellinum.* Face similar but the tubercle just a little more prominent and the pile fine, yellowish white. Front broad, its width at antennae equal to its length, gradually narrowing to opposite the anterior ocellus so that it is less than three-fourths as wide here as below, and it is again a little broadened so that at the posterior angles of the eyes it is three-fourths as wide as below. Pile black; across the middle broadly, on the sides below and at the vertex yellowish. Yellowish pollen underlies the pale pile, but is less abundant on the middle of the front; front shining black. Occiput with thick, yellowish pollen above, grey below, pile yellowish.

Thorax metallic blackish green, the pleura and sides of dorsum before the suture grey pollinose; pile whitish.

Legs yellow, front tibiae just a little larger than usual; hind legs black, the basal fourth and apical fifth of the femora, broad bases and apices of the tibiae and just the tip of their basitarsi, yellow. The front femora in the type bear three long, curved hairs and one of these bears a knob as in the ♂, but in the two paratypes these hairs are shorter, although they are quite evident and may not be rectangularly bent.

Wings sub-hyaline, otherwise as in ♂.

Abdomen actually very much as in the ♂ but appearing rather different, as the black side margins are a little more broadened behind and the yellow spots therefore more rounded on their postero-lateral margin and the apex of the fifth segment is black in its entirety; the anterior angles of the sixth segment are yellow. The second segment is practically as in the ♂ in two specimens. Pile as in ♂. Venter wholly yellow.

Holotype—♂, Banff, Alberta, June 18, 1922 (C. B. D. Garrett), No. 519, in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—♂, 2♀, same data; 4 ♂, June 1, 1922; 3 ♂, June 5, 1922; 1 ♂, June 9, 1922, all Banff, (C. B. D. Garrett), in the Canadian National Collection, Ottawa.

The ♂ is quite readily recognized by the peculiar lamellate hairs on the front femora and the ♀ by the longer, curved hairs, wholly black antennae, abdominal maculation, etc.

Platychirus peltatoides new species

Closely allied to *peltatus* Meig., but readily distinguished in the ♂ by the brown knobs of the halteres, the absence of a conspicuous brush of pile on either side of the middle tibiae basally, although there are some pale hairs in front; the longer and more dense black pilose pad beneath the front trochanters, the black-haired mesopleura, and generally darker legs. The ♀ is distinguished with greater difficulty but the pile beneath the front trochanters is quite apparent, while in *peltatus* it is only seen with difficulty. In both sexes the face is more prominent below, the anterior oral margin being produced more sharply, the tubercle more horizontal below, more acute, and the median facial line is more raised.

Length, 9 to 11 mm. *Male.* Face shining greenish black in ground color, but appearing strongly brassy owing to the thin yellow pollen; in profile produced below, almost straight on upper three-fifths, still a little hollowed, the tubercle nose-shaped, rather narrow, between it and the less prominent anterior oral margin, shortly but rather deeply concave. There is, however, some variation in the profile, but it is slight. The middle of the face is rather pinched, so that there is a median raised ridge, rising at the antennae and spreading into the tubercle, distinctly carinate on the upper half as it is bordered by a very evident depression, more rounded and broader on lower half. Tubercle and oral tip black. Frontal triangle black, dulled by brownish yellow pollen. Pile of face, frontal and vertical triangles all black. Occiput yellowish pollinose, the upper third concealed by the eyes from lateral view, pile yellowish, the orbital ciliae black; cheeks pale yellowish pilose, sometimes a few black hairs in front. Antennae black, sometimes the second joint below and the third on the lower half except at the immediate apex, reddish; third joint sub-oval, its apex rounded, about one and one-fourth times as long as broad. Arista slender, thickened and tapering on basal half. Eyes touching for a greater distance than the length of the ocellar triangle.

Thorax aeneous, sometimes distinctly brassy, the pile rather abundant, yellowish, but a broad longitudinal band on either side of the mesonotum, united behind, brownish or blackish. Mesopleura and an area beneath the base of the wing, black pilose, or more than half so. Scutellum concolorous with thorax, its pile black, but the margin bears almost all yellow hairs and sometimes there may be yellow hairs intermixed with the black on the disc; the ventral fringe is long, yellow.

Front four femora black on the basal third, elsewhere reddish yellow; hind femora except their apex, their tibiae except base and narrow apex and their tarsi wholly, black or piceous black. Middle tibiae sometimes on the inside beyond the middle, and their tarsi above, somewhat brownish or piceous. Front femora with very short whitish pile; behind with a dense ciliation of long black

hairs, posteriorly and ventrally with sparse black hairs. Front tibiae short yellow-haired, behind with a fringe of long hairs, those in the middle or extending almost to the widening, black; expanded rather suddenly on the posterior side, between the middle and projection, largely blackish or brownish. Front basitarsus half as long as the tibia on the front side, much shorter posteriorly, its apex almost evenly oblique, anteriorly very slightly convex, posteriorly oblique at the base, thence straight to the apex; second joint broadened, but only three-fourths as wide as the first, its base following the apex of the first, its apex very slightly oblique; three following joints of equal width, normal. Middle femora with short, white hair, behind with long black hairs, which are rather sparsely placed, below with short black bristles on its apical three-fourths; in front excavated on the apical half. Middle tibiae with short, appressed, pale yellowish pile; on the margins longer, sometimes largely blackish, especially on basal half, always more or less so before the middle: the basal third is straight the apical two-thirds arcuate, bearing a tuft of short black pile at the end of the straight portion. Hind legs simple, the basitarsi slightly swollen, tapering from the base.

Wings cinereous or slightly brownish hyaline, the anterior crossvein joining the third vein at almost a right angle, but never slightly recurved Squamae brownish, with yellow or golden yellow fringe. Halteres brown or fuscous, the stem yellow.

Abdomen opaque black, the first segment, side margins and apices of the last two segments, aeneous, brassy or bronzed, sometimes with two of these colors; normally with four pairs of yellow spots, the first pair rarely only faint; first pair of spots usually subrectangular, rather truncate externally, a little concave behind, convex in front, somewhat narrowed and rounded inwardly, situated slightly before the middle of the second segment. Second pair basal, inwardly narrowly separated from base, very slightly convex medianly, slightly concave posteriorly, longer medianly. Third pair of spots similar but moderately separated from the anterior margin and slightly smaller. The spots on the fifth segment are in the form of transverse, basal triangles which reach quite or almost to the posterior margin laterally and are broadly separated medianly and usually quite reaching the lateral margin. In dark specimens the first and last pair of spots are smaller, less clearly outlined and irregular. Pile pale yellowish, black on black areas except basally; rather long.

Female. Exceedingly like ♀ of *peltatus,* but differing in facial profile, which is very similar to the male, the tubercle a little more truncate. Pollen on face more dense than in ♂; and deeper in color than in *peltatus.* Front black, with more or less strong bronze reflection; wholly short black pilose; on the lower two-thirds, broadly expanded in the middle, yellow pollinose. Occiput yellow pollinose, with greyish tinge below, pale yellowish pilose, the ciliae black or grey. Facial pile rather abundant, whitish.

Thorax and scutellum wholly short, whitish, fine pilose, the sides of the mesonotum and pleura greyish white pollinose.

Legs simple, reddish; the apical half or more of the hind femora, their tibiae except the base and a broad, more or less obscure median band, and the hind tarsi wholly, black; tibiae with sub-apical or darker brownish bands.

Pile wholly white. Anterior trochanters with quite conspicuous short white hairs beneath. Wings hyaline. Halteres yellow.

Abdomen sub-opaque, the spots more similar in shape than in the ♂ and placed nearer the bases of the segments, those on the second segment well separated from the base, slightly wider than the following two, which occupy scarcely more than the basal half and are similar in shape to those on the third segment in the ♂. The triangles on the fifth segment are narrower, reaching only half way to the posterior margin at the sides, and not reaching the lateral margin. All the spots with a hoary sheen in certain lights. Pile short, white and black. Venter with a median longitudinal rather broad brownish stripe on the last three segments.

Holotype—♂, Penticton, B.C., May 10, 1919, (E. R. Buckell); No. 584, in the Canadian National Collection, Ottawa.

Allotype—♀, Vernon, B.C., June 30, 1920, (M. H. Ruhmann).

Paratypes—♂, Penticton, B. C., June, 1918, (R. C. Treherne); ♂, Victoria, B. C., May 3, 1919, (W. B. Anderson); ♂, Royal Oak, B. C., May 13, 1917, (R. C. Treherne); ♂, Ilwaco, Wash., May 5, 1918, (A. L. Melander), the latter in the collection of Dr. Melander.

Previously confused with *P. peltatus*. Probably most of the British Columbia records for *peltatus* refer to *peltatoides*. In the males the middle femora and tibiae are quite different in shape. The present species is decidedly darker.

Chilosia subchalybea n. sp.

Steel blue; base of wings yellow; antennae red, arista black, short pubescent, first posterior cell moderately acute.

Length 8 mm., wing 8 mm. *Female*. Head deep, shining black, the broad, facial strips and a triangular spot on the frontal orbits yellowish pollinose. Face deeply concave above, the tubercle more prominent than the antennal base, not large, moderately sharp; below the tubercle shortly perpendicular; facial slopes with fine, yellowish pubescence; side strips with very short, white pile. Front very wide, the transverse depression very conspicuous; with a shallow longitudinal furrow; pile wholly black, rather short. Occiput with short, black pile above, pale below. Antennae red, third joint moderately large, orbicular, slightly longer than broad; arista black, short black pubescent.

Thorax steel blue, in some lights with a geminate greyish median stripe; on the dorsum the pile is short, black, on pleura and humeri, short, whitish. Scutellum concolorous with the dorsum, black pilose, with six black bristles.

Legs black; extreme apices of femora and basal fourth of tibiae yellow. Pile pale on the femora; on apical fourth black; on tibiae black; pubescence on front and hind tibiae golden yellow.

Wings slightly cinereous hyaline, clear; yellowish basally; stigma yellow. The apical crossvein joints the fourth vein at almost a right angle, but the first posterior cell is rather sharp. Squamae white, with yellow border and white fringe. Halteres yellow.

Abdomen steel blue; black pilose; first segment, sides of second and remaining segments, more or less broadly, white haired.

Holotype—♀, Cranbrook, B. C., May 16, 1922, (C. B. D. Garrett), No. 572, in the Canadian National Collection, Ottawa.

Paratype—♀, same data, May 17th.

This species is allied to *burkei* and *alaskensis* but differs from the types of both of those species. The first posterior cell is less acute than in either the antennae, facial profile and color of legs are different.

Pteromicra canadensis n. sp.

Face yellow laterally or almost wholly so in ♂; front opaque black, a broad, median vitta polished obscure reddish; upper half of frontal orbits broadly shining black; legs chiefly yellow, front tibiae and tarsi wholly black.

Length 4 to 5 mm. *Male.* Face polished orange yellow, sometimes with an elongate oval median stripe in middle portion blackish; sides broadly whitish yellow pollinose, a narrow band of similar pollen extending across immediately below the antennae; in profile retreating, the lower fourth perpendicular. Front, opaque black, the lower sixth yellowish, polished; median vitta over one-third as wide as the front, narrower anteriorly, obscure reddish, polished; orbital margin on upper half broadly shining black, the opaque color inside this stripe about as wide as the distance between the posterior ocelli, the spots narrowing on anterior half. A few short black hairs along the edges of the median vitta, the anterior fronto-orbital bristles slightly over half as long as the posterior. Occiput shining black, the lower orbits pollinose like the face, above the neck with a rectangular, silvery, slightly oblique spot on either side of the middle. Antennae red, upper margin of third joint narrowly black; third joint obtusely rounded apically, its base a little broader, very slightly concave on middle portion above. Arista black, densely short black pubescent.

Thorax shining black; mesonotum thinly brownish yellow pollinose; lower half of pleura and the coxae, white pollinose. Only the mesonotum with short, black, stout hairs and long bristles; scutellum with four bristles.

Legs, including the coxae, reddish yellow; apical third of front femora, their tibiae and tarsi wholly, and last two joints of the remaining tarsi, black; hind femora brownish on narrow apex above. Front and hind femora with a row of four to six fine bristles above on apical half; the latter with conspicuous pile below; all tibiae with preapical bristle. Pile wholly black, rather short.

Wings greyish hyaline; stigma luteous. Squamae whitish with yellowish border and white fringe. Halteres yellow.

Abdomen shining black, with short black pile; longer laterally. Genitalia large, longer than fifth segment; fifth segment longer than the fourth, second to fourth segments sub-equal, the third just a little shorter. Venter thinly yellowish pollinose.

Female. Middle or shining portion of face black, except just inside the pollinose stripes; front opaque black quite to the base of the antennae, the median vitta appearing more reddish.

Dorsum of thorax with a rather broad, more shining stripe on either side of the middle line in front.

Only the basal fourth or less of the front femora yellowish; fewer bristles on femora and shorter hairs.

Abdominal segments with same relative lengths as in the ♂, the third shorter than either the second or fourth, the fifth ventral longer than its dorsal, so that the terminal segments are visible from above.

Holotype—♂, Banff, Alta., May 5, 1922, (C. B. D. Garrett), No. 581, in the Canadian National Collection.

Allotype—♀, same data.

Paratypes—♂, 2♀, same data, ♀ June 1.

This species is quite distinct from *P. glabricula* Fallen. *In glabricula* the palpi are yellow and the sides of the front narrowly whitish. In *canadensis* the palpi are deep black and there is no trace of white on the front.

Meromyza lineola n. sp.

Green; mesonotum with three broad black stripes; abdomen with a median black vitta narrowly interrupted at the suture.

Length 2.75 to 4 mm. *Male* and *Female*. Face, cheeks and occiput yellowish green; the former moderately retreating, shorter than the oral margin from tip of epistoma to back of head. Front broad, yellow; with very short black hairs; almost flat, swollen just above the antennae, a cordate black spot covering the ocellar triangle. Antennae yellow green, third joint brown above, arista tapering, black.

Thorax pale green; mesonotum with a broad, median, black stripe, slightly tapering, to the tip of the scutellum; on either side, separated by a narrow yellow green strip, which is widest posteriorly, a broad black stripe which reaches just onto the corners of the scutellum, and rises distinctly behind the humeri; the whole with a whitish sheen due to pollen. The mesonotum may be described as black, with the narrow lateral margins and a narrow stripe on each side of the middle line, connected anteriorly with the lateral stripes, yellow green. What hair is present is white and almost imperceptible. There are two small, black bristles on the postalar calli and one inside them on the yellow ground. The scutellum may be described as greenish yellow, with a broad, longitudinal median vitta, not quite reaching the apex, and the lateral margins on the basal half, brownish or black. Sometimes a small black spot on the mesopleura below.

Legs green; femora yellowish greenish; tarsi ochre green, the last joint brownish; all the femora rather robust. Wings hyaline. Halteres green.

Abdomen green; second to fifth segments with a narrow, median, black vitta, narowly interrupted just before the sutures; first segment with a longitudinal elongate oval black spot on either side, its apex on the base of the second segment, its base well separated from the base of the first segment and moderately separated from the side margins; sixth segment with a narrow, black basal border which expands a little before the lateral margins, but is narrowly separated from them; or the segment may be half black. There may rarely be a broad obscure reddish brown stripe on the curved undersides of the third to fifth segments. Genitalia at the base with an arch of long, pale hair, the hair twice as long as in *americana*.

Holotype—♂, Fort Simpson, Mackenzie River, N.W.T., June 25, 1922, (C. H. Crickmay), No. 577, in the Canadian National Collection.

Allotype—♀, same data.

Paratypes—♂, 4♀, same data.

The four species in the collection may be distinguished by the following key.

1. Abdomen all blackish except the curved underside margins and narrow incisures ..... *marginata* Beck.
   Abdomen at least with an elongate yellow spot on either side of second segment 2
2. Abdomen with median and sub-lateral black vittæ which are quite distinct even though there may be brownish diffuse color surrounding; yellow thoracic stripes complete and broad ..... *punctifer* Beck.
   Abdomen with three black vittae, when present, not distinctly darker than the brown ground color 3
3. Yellow thoracic stripes complete; ♂ genitalia with long, arched hairs basally; arista brown; scutellum never all yellow ..... *lineola* Curran
   Yellow thoracic stripes often incomplete; ♂ genitalia with short hairs; arista yellow basally; scutellum often all yellow ..... *americana* Fitch

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NEW SPECIES OF BUPRESTIDAE FROM THE UNITED STATES (COLEOPTERA)

BY C. A. FROST,
Framingham, Mass.

Ptosima idolynae sp. nov.

Closely related to *gibbicollis* Say from which it differs as follows: form longer and more robust; color a brighter and lighter blue; a round yellow spot on the vertex, a faint linear sub-basal one each side of the elytral suture near the scutellum, a broader fascia at apical third, a rounded apical spot on each elytron, no subhumeral vittae; thorax notably more elongate, more convex and with the sub-apical tumidity less evident; ante-scutellar depression slight and with a finely impressed line on basal third; side margin more arcuate when viewed laterally. Elytral suture depressed for a short distance behind the scutellum and then elevated as usual to apex; humeri indistinct, nearly smooth and aeneous. Second, third and fourth abdominal segments with a wider smooth band posteriorly; slightly less pubescent beneath. With the exception of the disk of the thorax where the punctures are deeper, coarser and more regular, the sculpture of both species is very similar. Length 8.8 mm. Width 3 mm.

This species is very distinct by the form of the thorax and the markings. The unique type, in my collection, is from Agricultural College, Miss., Apr. 20, 1920.

Agrilus pseudofallax sp. nov.

Form, color and size similar to the darker bronze and more robust specimens of *fallax*. Antennae passing the middle of the thorax and serrate from the fifth joint; head greenish, nearly flat with a faintly indicated median, longitudinal concavity which becomes narrower and well defined on the vertex, central area of the front with rather sparse punctures and faintly indicated rugae, just above the clypeus more distinctly transversely rugose, and on the vertex longitudinally punctato-strigate. Thorax one-fourth wider than long, narrowed at the base; sides slightly explanate and arcuate to behind the middle, then faintly

sinuate to the sharply defined angles which have a straight obtuse carina; margin sinuate; disk with an evident depression, which is deeper behind the middle; lateral oblique depression deep, with sparse yellowish pubescence, transversely strigate over entire surface of thorax.

Scutellum finely transversely carinate; elytra slightly sinuate at the sides, humeral and discal depressions similar to *fallax*, surface granulate-imbricate with very evident tendency to transverse strigations; each elytron has three yellowish pubescent spots as in *fallax*, the median one being nearly circular. Beneath with sparse pubescence, more evident on the median line to behind the middle of the second ventral segment; first ventral flat or slightly concave and finely strigate, abdomen becoming nearly smooth at the middle of the posterior segments. Prosternal lobe distinctly emarginate with the sides faintly sinuate, narrowing the front, intercoxal process broad and apparently truncate, moderately densely pubescent, propleura reticulated with minute rugae. All claws broadly toothed; anterior and middle tibiae mucronate. Length 6 mm. Width 1.7 mm. at the middle of the thorax and behind the middle of the elytra.

The above description is made from the (male) type which is labelled "Allegheny, Pa." Paratype No. 1 is labelled "Hazen, Ala., IV-4-'21, beating oak; L. E. Woodruff, Collector." This is a small (5 mm.) male of a brighter coppery bronze with a greenish front which is indistinctly concaved longitudinally; pygidium sparsely punctured with a faintly indicated obtuse carina. Paratype No. 2 is a male (6.3 mm. long and 2 mm. wide) from Jeanette, Pa., VI-26 and was taken, I understand, by H. G. Klages. This specimen has the thorax more narrowly and shallowly depressed with sharp carinae at the hind angles; the pygidium is more densely punctured along each side of a very evident obtuse carina, sides smooth. Paratype No. 3 is a female (6 mm.) labelled simply "Ohio." The front is coppery bronze and more evidently concave; thorax with a slight concavity in front of the scutellum and with the carinae moderately sharp. Paratype No. 4 is a very dark, robust female (6.8 mm. long and 2.1 mm. wide) labelled "Ind." and also "Stein coll. Indiana." It has a very pronounced concavity of the front and a deep discal concavity on the thorax; the basal carinae sharply defined. Received from W. S. Blatchley. Paratype No. 6 is a male from "Kans." and is very nearly typical. Paratype No. 7 from "Cin., O." resembles No. 4 very closely. The type and paratypes, Nos. 1, 3 and 5, are in my collection; Nos. 2 and 6 are in the collection of Mr. J. N Knull; No. 4 is in the collection of Mr. H. G. Klages. No. 7 is in the collection of Mr. Charles Dury.

This species has been confused with *fallax* through inattention to the antennal characters, and in Horn's table runs to *impexus* Horn and *floridanus* Crotch. Mr. J. N. Knull, who has very kindly compared one of the paratypes with specimens in the Horn collection, states that it is entirely different from either of these two species. He finds it is smaller and differs from the type of *impexus* by the less convex and less coarsely sculptured prothorax, head not deeply channeled, sides of the abdomen without the marked pubescent patches, and by the middle pubescent spot of the elytra not elongate. He finds that the specimen of *floridanus*, marked "Type," has a very convex prothorax and a deeply channeled front and vertex.

Chrysobothris orono Frost.

Through the kindness of Mr. J. N. Knull I have been able to examine a female of this species from Orono, Me., with date of July 26, 1905. It resembles the male type very closely, differing only in the more broadly rounded front angles of the prothorax, the slightly less prominent costae and smaller and less numerous black smooth patches of the elytra; it is more coppery beneath and, as usual in the females, less pubescent; the front tibiae are arcuate as in the male, the middle ones less so, and the hind ones straight; last ventral broadly and shallowly emarginate; last dorsal entire. This female strongly resembles some of the same sex in a series of about 75 specimens of *verdigripennis* which were taken on spruce at Macdiarmid, Ont., July, 1922, by Mr. N. K. Bigelow, of the Royal Ontario Museum, but in these the emargination of the last ventral is deep and narrow, the elytral sculpture more rugged and the form slightly more convex, while the reddish-yellow lobes of the eight outer joints, together with their more strongly pointed shape, are distinctive. In the present female of *orono* there are faint indications of reddish color in the lobes of the outer joints and it is possible that specimens may occur with the lobes as testaceous as in *verdigripennis* or *dentipes*, although in the many specimens of these two species examined none have been seen with black or even piceous lobes. In regard to this character it may be mentioned that many specimens, otherwise not separable from *C. femorata* with the knowledge we now possess concerning this apparently complex mass of species or varieties, have been seen with the lobes of the outer joints of the antennae of this same testaceous color.

NEW SPECIES OF NORTH AMERICAN PLECOPTERA

BY P. W. CLAASSEN,
Cornell University, Ithaca, N.Y.

(Continued from Page 257)

Nemoura glabra sp. nov.

Plate XIV, figs. 1 and 2.

Length to tip of wings; male, 7 mm., female, 7.5 mm. Expanse, male, 11 mm., female, 14 mm.

General color dark brown. Head wider than prothorax; hind ocelli closer to eyes than to each other. Prothorax much wider than long, moderately rugose, widened behind, angles broadly rounded. Wings lightly to rather heavily infuscated, with two indistinct transverse darker bands; anal field of hind wings large. Gills apparently absent.

Genitalia: *Male*. Subanal lobes entire, unmodified; cerci large, membranous; supraanal process recurved, long, not much widened, smooth and completely chitinized; subgenital plate short; ventral lobe wide, about twice as long as wide.

Female. Seventh sternite unmodified; eighth sternite not produced and with a suggestion of a slight notch in center.

Holotype, male; *allotype*, female; 30-4-13, Truro, N. S., Cornell University Collection.

Paratypes: 1 male and 1 female, same locality as type; 1 male and 1 female, March, '08, Boulder, Colo.; 1 male, Logan, Utah.

Nemoura divergens sp. nov.

Plate XIV, fig. 3.

Male. Length to tip of wings 8.5 mm.; expanse 15 mm.

General color brown. Head not wider than prothorax, brown, occiput quite rugulose; hind ocelli a little closer to eyes than to each other. Prothorax brown, wider than long, widened behind; angles broadly rounded. Legs light brown. Wings subhyaline with a darker band across the cord and somewhat darker at the tip; anal field of hind wings large.

Genitalia: *Male.* Subanal lobes unmodified; subgenital plate quite short; cerci large, membranous; ventral lobe about twice as long as wide; supraanal process recurved, smooth, entirely chitinized; each side of the supraanal process a long, slender, chitinized, divergent process.

Female. unknown.

Holotype, male, Mar. 15, Clinton, N. Y., P. B. Powell, Cornell University Collection.

Paratypes: 1 male, Apr. 17, Ithaca,, N. Y.; 1 male, Mar. 30, Forest Hills, Mass.

Nemoura biloba sp. nov.

Plate XIV, figs. 4 and 5.

Length to tip of wings: male, 8.5 mm., female, 9 mm. Expanse, male, 17 mm., female, 18 mm.

General color brown. Head a little wider than prothorax, uniformly brown; hind ocelli about twice as close to eyes as to each other. Prothorax wider than long, somewhat rugose; a little widened behind; angles narrowly rounded. Legs brown, the femora somewhat darker toward the end. Wings uniformly subhyaline; anal field of hind wings large. Gills present.

Genitalia: *Male.* Subanal lobes prolonged, upcurved, and at the tip divided into two slender processes; cerci large, membranous; at base of cerci an inward pointing, short, membranous, oblong lobe suggestive of a second small cercus; supraanal process recurved, slender, membranous above; subgenital plate somewhat prolonged; ventral lobe a little more than twice as long as wide.

Female. Seventh sternite very slightly produced posteriorly; eighth sternite with a narrow median notch.

Holotype, male; *allotype*, female; and one *paratype*, Los Angeles Co., California, Cornell University Collection.

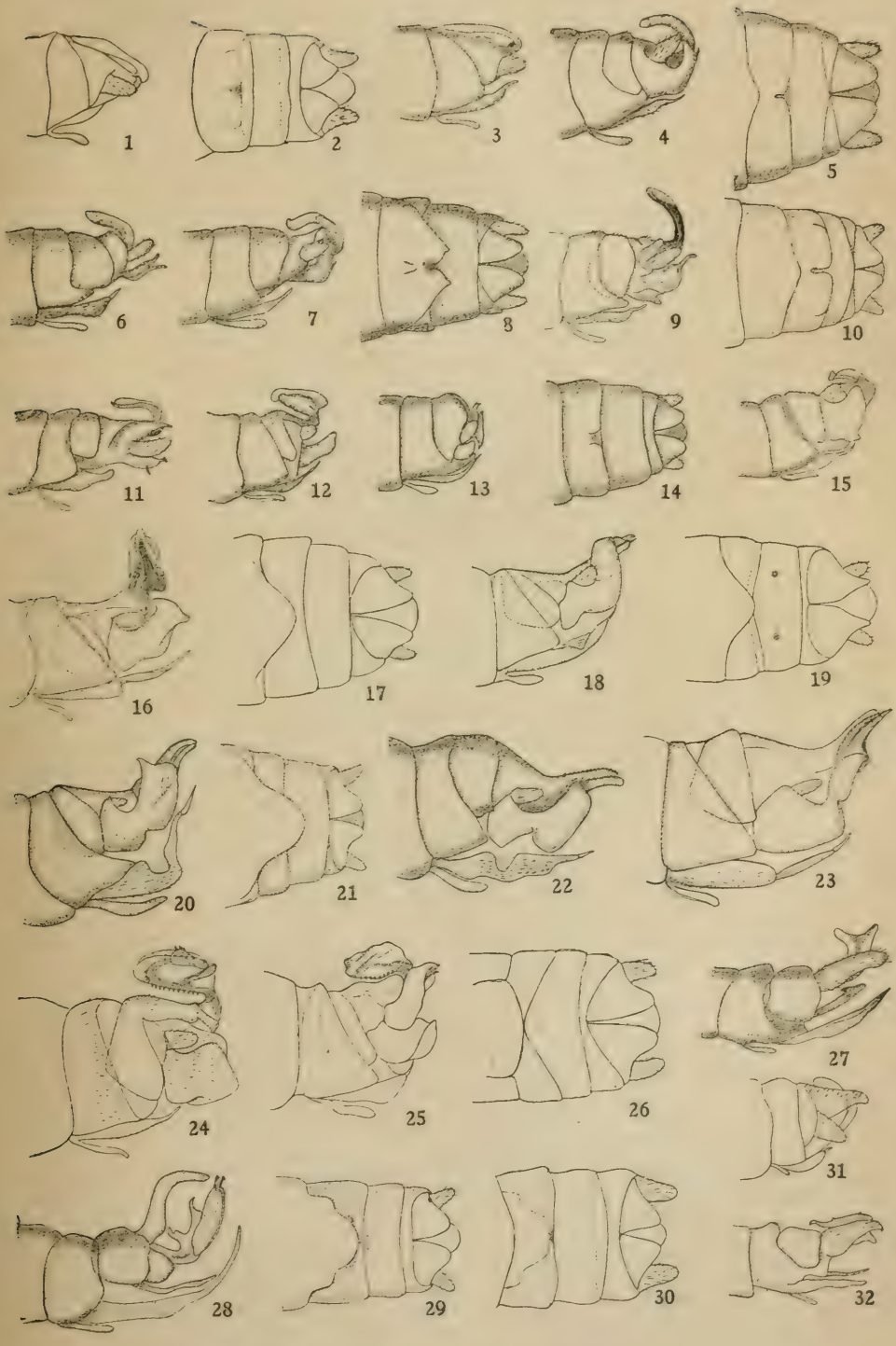
Nemoura bifurcata sp. nov.

Plate XIV, fig. 6.

Length to tip of wings, male, 9 mm.; expanse, 14.5 mm.

General color brown. Head a little wider than prothorax, occiput somewhat rugose; hind ocelli about twice as close to the eyes as to each other. Prothorax brown, a little wider than long, hardly narrowed behind; angles rather sharp; surface somewhat rugose. Legs brown. Wings uniformly subhyaline; anal field of hind wings large. Gills apparently absent.

Genitalia: *Male.* Subanal lobes considerably produced and deeply bifurcate at the tip; cerci membranous; supraanal process recurved, membranous above and dorsally finely spinulose; subgenital plate rather short; ventral lobe about two and one-half times as long as wide.



NEW NORTH AMERICAN PLECOPTERA.

Female. unknown.

Holotype: male, 5-15-95, without locality label. Cornell University Collection.

Nemoura californica sp. nov.

Plate XIV, figs. 7 and 8.

Length to tip of wings: male, 8 mm., female, 8.5 mm; expanse: male, 14.5 mm., female, 15 mm.

General color brown. Head a little wider than prothorax; uniformly dark brown; hind ocelli at least twice as close to eyes as to each other. Prothorax uniformly brown; wider than long, somewhat narrowed behind, surface nearly smooth, angles rather narrowly rounded. Legs brown. Wings subhyaline; anal field of hind wings narrow. Gills present in four groups of filaments in cervical region.

Genitalia: *Male.* Subanal lobes wide, produced, upcurved and bearing before the apex a short tooth; cerci membranous; at base of cerci a short, inward pointing, chitinous horn; supraanal process recurved, much widened beyond base, the membranous portion finely spinulose; sub-genital plate quite short; ventral lobe narrow, at least three times as long as wide.

Female. Seventh sternite unmodified; eighth sternite considerably produced, with a median notch and just before the notch a blunt tubercle.

Holotype: male, Mar. 22, 1908, Oakland Hills, Alameda, Co., Calif., E. C. Van Dyke. In the collection of the California Academy of Sciences.

Allotype: female, Apr. 6, 1897, Seattle, Washington.

Paratypes: 1 male, May 27, 1903, Fieldbrook, Calif., H. S. Barber; 1 female and 1 male, May 15, 1894, Olympia, Washington; 2 males, 7-20-03, Bear Lake, B.C.; 1 male, Sept. 4, 1891, Bouter's Ranch, Mont.

Nemoura flexura sp. nov.

Plate XIV, figs. 9 and 10.

Length to tip of wings: male, 6.5-7 mm. female, 8-9 mm.; expanse: male, 10.5-11 mm., female, 13-14 mm.

General color brown.

Head wider than prothorax, dark; occiput slightly rugose; hind ocelli about twice as close to eyes as to each other. Prothorax wider than long, narrowed behind, quite rugose, the rugosities rather coarse; angles quite broadly rounded. Legs brown. Wings uniformly subhyaline; anal field of hind wings narrow.

Genitalia: *Male.* Subanal lobes produced into slender, flexuous processes which are upturned; cerci membranous; at base of cerci originates a lobe suggestive of a second cercus; supraanal process slender, recurved, membranous above near tip; subgenital plate short; ventral lobe slender, about three times as long as wide.

Female. Seventh sternite somewhat produced, almost tuberculate in the middle; eighth sternite with a deep, median notch.

Holotype, male, *allotype*, female; Boulder, Colorado, G. C. Dodds. Cornell University Collection.

Paratypes: 5 males and 8 females, same locality.

Nemoura cornuta sp. nov.

Male. Length to tip of wings 7.5 mm.; expanse, 12.5 mm.

General color brown. Head wider than prothorax; hind ocelli closer to eyes than to each other. Prothorax brown, narrow, a little longer than wide, surface somewhat rugose; sides straight, angles rather narrowly rounded. Legs uniformly brown. Wings uniformly hyaline; anal field of hind wings large. Two groups of gills in the cervical region.

Genitalia: *Male.* Subanal lobes prolonged into irregular chitinized processes bluntly pointed; cerci membranous; above the cercus a horn-like chitinized process about as long as the cercus; supraanal process recurved, slender, membranous above, chitinized below; subgenital plate rather short, the tip truncate; ventral lobe slender, about four times as long as wide.

Female. unknown.

Holotype: male, June 22, 1920, Nanaimo, B.C., Biological Station, E. P. Van Duzee. In the collection of the California Academy of Sciences.

Nemoura frigida sp. nov.

Plate XIV, fig. 12.

Male. Length to tip of wings 7 mm.; expanse 12 mm.

General color dark brown. Head wider than prothorax, smooth, covered with fine pile; the hind ocelli at least twice as close to eyes as to each other. Prothorax wider than long, much narrowed behind, quite rugose, uniformly brown; angles quite sharp. Legs uniformly light brown. Wings uniformly subhyaline; anal field of hind wings large. Gills present.

Genitalia: *Male.* Subanal lobes entire, somewhat produced and broadly truncate behind; cerci membranous and small; supraanal process recurved, enlarged and largely membranous; subgenital plate only moderately produced; ventral lobe about three times as long as wide.

Female. unknown.

Holotype: male, June 16, 1899, Sitka, Alaska, Harriman Expedition, T. Kincaid. In the National Museum, Washington, D. C.

Nemoura delicatula sp. nov.

Plate XIV, figs. 13 and 14.

Length to tip of wings: male, 6 mm.; female, 7.5 mm.; expanse: male, 10.5 mm.; female, 13.5 mm.

General color light brown. Head much wider than prothorax, brown; hind ocelli closer to eyes than to each other. Prothorax brown, quite rugose; wider than long; angles very broadly rounded. Legs light brown. Wings uniformly hyaline; veins faint; anal area of hind wings narrow. Gills absent.

Genitalia: *Male.* Subanal lobes slightly, if at all, modified; cerci small, membranous; supraanal process recurved, broadly truncate at tip, fitting closely into a depressed area of the tenth tergite, partly membranous and bearing above two chitinous projections; the tenth tergite each side with a raised chitinized lobe; subgenital plate rather short; ventral lobe about three times as long as wide.

Female. Seventh sternite not produced posteriorly; eighth sternite unmodified, the genital opening not guarded by valves.

Holotype, male; *allotype*, female and 24 *paratypes*, males and females, from Boulder, Colorado, G. C. Dodds, Cornell University Collection.

Nemoura columbiana sp. nov.

Plate XIV, fig. 15.

Male. Length to tip of wings, 6.5 mm.; expanse, 11 mm.

General color dark brown with banded wings and legs. Head wider than prothorax, blackish brown; hind ocelli closer to eyes than to each other. Prothorax blackish brown, slightly rugose, wider than long, narrowed behind; front angles broadly rounded; hind angles almost sharp; sides straight. Legs brown, with a light spot or band just beyond the middle on femora. Wings subhyaline, with two dark, transverse bands, one at the cord and the other before the tip; anal field of hind wings large. Four single gills present in the cervical region.

Genitalia: *Male.* Subanal lobes large, curved upward and bearing on the inner margin (ventral view) a curved, spine-like process; below (side view) a short triangular process; cerci small, membranous; supraanal process recurved, short, enlarged, partly membranous; subgenital plate quite short; ventral lobe truncate, a little more than twice as long as wide.

Female. unknown.

Holotype: male, June 25, 1908, between Laggan and the Valley of the Ten Peaks, Alberta, Can., J. C. Bradley, Cornell University Collection.

Nemoura producta sp. nov.

Plate XIV, figs. 16 and 17.

Length to tip of wings: male, 11 mm.; female, 11.5 mm.; expanse: male, 20 mm.; female, 21 mm.

General color brown to blackish brown. Head wider than prothorax, nearly smooth; hind ocelli a little closer to eyes than to each other. Prothorax wider than long, slightly narrowed behind; angles quite sharp. Legs brown, not banded. Wings subhyaline; 1st A and 2nd A of forewing united before margin; anal field of hind wings large. Gills apparently absent.

Genitalia: *Male.* Subanal lobes broad, produced, upcurved and enlarged at tip (side view), on the inside (ventral view) armed with a stout spinelike process; cerci small, membranous; supraanal process bent up but not recurved, with chitinous structures surrounded by a finely spinulate membrane; subgenital plate long, narrow; ventral lobe about three times as long as wide.

Female. Seventh sternite produced into a narrow, evenly rounded subgenital plate which reaches across most of segment eight; eighth sternite unmodified.

Holotype, male; *allotype,* female; without any label. Cornell University Collection.

Nemoura nevadensis sp. nov.

Plate XIV, figs. 18 and 19.

Length to tip of wing: male, 10.5-11 mm.; female, 14.5-15 mm.; expanse: male, 17-18 mm., female, 22-24 mm.

General color dark brown. Head a little wider than prothorax; lateral tubercles large; hind ocelli closer to eyes than to each other. Prothorax dark brown, somewhat lighter on the lateral and anterior margins; wider than long; somewhat narrowed behind; front angles narrowly rounded, hind angles more broadly rounded. Legs brown. Wings subhyaline, veins heavy, somewhat

infuscated at the stigma; 1st and 2nd A of front wings united before the margin; anal field of hind wings large. Gills absent.

Genitalia: *Male.* Subanal lobes very large, upcurved, the tip slightly truncate, cerci very small, membranous; supraanal process produced backward and upward, the outer sheaths wide and bearing spines on upper and lower margin; inner sheaths slender, unarmed; subgenital plate very long, upcurved, with many transverse ridges before the tip; ventral lobe large, about twice as long as wide.

Female. Seventh sternite produced over the entire eighth segment as an evenly rounded subgenital plate; eighth sternite unmodified.

Holotype, male; *allotype*, female; 1878, Reno, Nevada, Morrison. In the Museum of Comparative Zoology, Cambridge, Mass.

Paratypes: 5 males and 9 females from Reno, Nevada, 1878, Morrison; 1 female, Eureka, Cal., May 22, H. S. Barber; 1 male, Yosemite Valley, California, 5-24-21, E. C. Van Dyke; 1 female, Tenino, Wash., H. G. Hubbard.

Nemoura washingtoni sp. nov.

Plate XIV, figs. 20 and 21.

Length to tip of wings: male, 9.5-10 mm.; female, 11 mm.; expanse, male, 16-17 mm.; female, 19 mm.

General color dark brown. Head a little wider than prothorax, uniformly brown; hind ocelli closer to eyes than to each other. Prothorax much wider than long, smooth, somewhat narrowed behind; front angles broadly rounded, hind angles subacute. Wings uniformly subhyaline except for a slight infuscation at the stigma; 1st and 2nd A of forewing united before the margin; anal area of hind wings large. Gills apparently absent.

Genitalia: *Male.* Subanal lobes very large, narrowed at base, upcurved and produced into a triangular process at the upper inner angle; cerci very small, membranous. Supraanal process not recurved but produced backward and upward, composed of a double sheath on each side, the inner sheaths broad and armed with spines above, the outer sheaths slender and unarmed; subgenital plate long, very hairy and turned up at right angles; ventral lobe large, about twice as long as wide.

Female. Seventh sternite produced backward into a rounded, subgenital plate which reaches beyond the hind margin of segment eight; genital opening not guarded by distinct valves.

Holotype: male, June 15, 1877, Mt. Washington, N.H., Cornell University Collection.

Allotype: female, June 16, 1916, Glen House, N.H., C. W. Johnson.

Paratypes: 2 females, June 14-16, 1916, Glen House, N. H., C. W. Johnson.

Nemoura carolinensis sp. nov.

Plate XIV, fig. 22.

Male. Length to tip of wings, 9 mm.; expanse, 16 mm.

General color brown. Head wider than prothorax, uniformly brown; hind ocelli closer to eyes than to each other. Prothorax wider than long, uniformly brown; slightly rugulose, considerably narrowed behind, angles narrowly

rounded. Legs uniformly brown. Wings uniformly subhyaline; anal field of hind wings narrow. Gills apparently absent.

Genitalia: *Male*. Subanal lobes entire, greatly enlarged, curved upward and in side view shaped somewhat like a boot; cerci small, membranous; supraanal process produced backward and upward, the outer sheaths membranous and finely spinulose; subgenital plate much produced and bent upwards; ventral lobe about twice as long as wide.

Female. unknown.

Holotype: male, 1877, Morgantown, N.C., Morrison. In the Museum of Comparative Zoology, Cambridge, Mass.

Nemoura interrupta sp. nov.

Plate XIV, fig. 23.

Male. Length to tip of wings 11.5 mm.; expanse 19 mm.

General color dark brown. Head wider than prothorax, covered with rather long hair; hind ocelli closer to eyes than to each other. Prothorax wider than long, somewhat narrowed behind; slightly rugose; angles quite sharp. Legs uniformly brown. Wings subhyaline, first and second A of forewing united before margin; anal field of hind wings large. Gills apparently absent.

Genitalia: *Male*. Subanal lobes prolonged and curved up at right angles, constricted near the middle, the lobe beyond evenly rounded and very finely spinulose; cerci small, membranous; supraanal process directed upwards and backwards, the outer sheaths with a dentate margin above; subgenital plate quite narrow, considerably prolonged, turning up almost at right angles, ventral lobe about twice as long as wide.

Female. unknown.

Holotype: male, 4-4-98, Seattle, Wash., Cornell University Collection.

Nemoura oregonensis sp. nov.

Plate XIV, fig. 24.

Male. Length to tip of wings 9.5 mm.; expanse 16 mm.

General color brown with banded legs and wings. Head wider than prothorax, brown, with a black spot inside the eyes just in front of hind ocelli; rest of head somewhat mottled; hind ocelli closer to eyes than to each other. Prothorax brown, quite rugose; the rugosities blackish; wider than long, narrowed behind; angles very broadly rounded. Legs dark brown; femora with a light, transverse band just beyond the middle. Wings infuscated, with a light, transverse band before the cord and one beyond; anal field of hind wings large. Four finger-like gills in the cervical region.

Genitalia: *Male*. Subanal lobes very wide, almost as wide as long, truncate, and bearing on the inside (ventral view) a small tooth; cerci short, membranous; supraanal process recurved, greatly enlarged, partly membranous, armed below with a double row of spines, above also with a few spines; subgenital plate short; ventral lobe truncate, about two and one-half times as long as wide.

Female. unknown.

Holotype: male, 6-21-22, Blitzen Valley, Harney Co., Oregon, W. J. Chamberlin. Cornell University Collection.

Nemoura trispinosa sp. nov.

Plate XIV, figs. 25 and 26.

Length to tip of wings: male, 8.5 mm.; female, 9 mm.; expanse: male, 14.5 mm.; female, 16.5 mm.

General color blackish brown. Head considerably wider than prothorax; hind ocelli about twice as close to the eyes as to each other. Prothorax slightly rugose, wider than long, narrowed behind; angles widely rounded. Wings uniformly subhyaline; anal field of hind wings large. Gills apparently absent.

Genitalia: *Male.* Subanal lobes wide, entire, with hind margin broadly bilobed; cerci greatly modified into accessory copulatory organs, the outer half heavily chitinized and terminating in three spines, the inner portion membranous; supraanal process recurved, much enlarged, largely membranous and below armed with small spines; subgenital plate short; ventral lobe broad, truncate, about one and one-half times as long as wide.

Female. Seventh sternite produced into a broadly rounded subgenital plate, which covers most of segment eight; eighth sternite unmodified.

Holotype, male; *allotype,* female; 17-20, June, '04, Mud Creek, Tompkins Co., N. Y., Cornell University Collection.

Paratype: 1 male, Murray Bay, Pro. of Quebec, July or August, 1878, E. Corning, jr.

Nemoura serrata sp. nov.

Plate XIV, fig. 27.

Male. Length to tip of wings 7 mm.; expanse 12.5 mm.

General color dark brown. Head wider than prothorax, occiput mottled with darker brown; hind ocelli nearly twice as close to eyes as to each other. Prothorax wider than long, sides straight, not narrowed behind; surface moderately rugose; front angles broadly rounded; hind angles quite sharp. Legs uniformly lighter brown. Wings uniformly subhyaline; anal field of hind wings narrow. Gills apparently absent.

Genitalia. Male. Subanal lobes entire, modified into slender processes, which are armed near the tip with two sharp, triangular spines; cerci long, chitinized, bent inward and ending in a sharp point; supraanal process very wide, curved upward and (side view) bifurcate at tip; subgenital plate arising from about the middle of the ninth sternite, narrow, divided at the tip, each half serrate on the outer margin; ventral lobe nearly three times as large as wide.

Female. unknown.

Holotype: male, June 8, 1921, Bar Harbor, Me., C. W. Johnson.

Paratype: male, June 3, 1920, Cranberry Lake, N. Y., C. J. Drake, Cornell University Collection.

Nemoura prolongata sp. nov.

Plate XIV, figs. 29 and 30.

Length to tip of wing: male, 7.3 mm.; female, 8.3 mm.; expanse: male, 12.5 mm.; female, 14.5 mm.

General color dark brown. Head very much wider than prothorax, nearly uniformly brown, rather thickly clothed with short hairs; hind ocelli closer to eyes than to each other. Prothorax dark brown, somewhat lighter toward the

lateral margins; little wider than long; hardly narrowed behind; angles rounded. Legs uniformly brown. Wings uniformly subhyaline. Gills apparently absent.

Genitalia: *Male*. Subanal lobes undivided and prolonged into long, slender, somewhat membranous processes; supraanal process turned up but not recurved, very complex, the outer lobes membranous and armed with spines, the central portion chitinized and armed with large, spine-like processes; cerci very long, chitinized and bent upward and inward; subgenital plate narrow, very long and curved upward; ventral lobe narrow, at least three times as long as wide.

Female. Seventh sternite produced into a subgenital plate, which reaches across the eighth sternite; genital opening not guarded by valves.

Holotype: 1 male, June 26, 1913, Bretton Woods, N.H., C. W. Johnson.

Allotype: 1 female, Orono, Me., Cornell University Collection.

Paratypes: 1 male, 1 female, Orono, Me.

Nemoura rotunda sp. nov.

Plate XIV, figs. 30 and 31.

Length to tip of wings: male, 7-7.5 mm.; female, 10-11 mm.; expanse: male, 11-12 mm.; female, 14-15 mm.

General color dark brown. Head much wider than prothorax; hind ocelli closer to eyes than to each other. Prothorax quadrangular, very little wider than long, slightly narrowed behind, quite rugose; angles rather narrowly rounded. Wings subhyaline, with two transverse darker bands; anal field of hind wings large. Gills apparently absent.

Genitalia: *Male*. Subanal lobes hardly modified; cerci membranous, inserted low on the side; just above each cercus a large, chitinous process covered with heavy spines, produced backward and inward; supraanal process short, enlarged, ending in complex lobes and chitinizations; subgenital plate short; ventral lobe circular, about as wide as long.

Female. Seventh sternite unmodified; eigth sternite somewhat swollen in middle and slightly produced into a subgenital plate.

Holotype, male; *allotype*, female; April, Waldeboro, Maine, Cornell University Collection.

Paratypes: 1 male, 5 females, Apr., Waldeboro, Maine; 1 male, Mar.-May, Waldeboro, Me., J. H. Lowell; 1 male, Mar. 12, Orono, Me.

Nemoura truncata sp. nov.

Plate XIV, fig. 32.

Male. Length to tip of wings 7 mm.; expanse, 12.5 mm.

General color brown. Head wider than prothorax, uniformly brown, covered with fine pile; hind ocelli closer to eyes than to each other. Prothorax uniformly brown, somewhat rugulose, wider than long, slightly widened behind, angles rather broadly rounded. Legs uniformly pale brown. Wings hyaline; anal field of hind wings large. Gills apparently absent.

Genitalia: *Male*. Subanal lobes entire, modified into slender, pointed processes which reach to the end of the subgenital plate; cerci large, chitinized, bent inward at the tip and ending in a sharp point; supraanal process recurved, closely appressed upon the tergum, much widened toward the tip and above with a small, pointed tubercle; subgenital plate arising from about the middle of the

ninth sternite, broadly truncate at the tip; ventral lobe small, about twice as long as wide.

Female. unknown.

Holotype: male, May 13, 1879, Walden, Mass., S. Henshaw. In the Museum of Comparative Zoology, Cambridge, Mass.

Nemoura punctipennis sp. nov.

Plate XIII, figs. 21 and 22.

Length to tip of wings: male, 6.5 mm.; female, 6.5-7.5 mm.; expanse male, 11.5 mm.; female, 11.5-13 mm.

General color black with banded legs and spotted wings. Head black, wider than prothorax, feebly pilose; a depression in the ocellar triangle; hind ocelli a little closer to eyes than to each other; eyes large. Prothorax blackish, wider than long, not narrowed behind; surface irregular but not very rugose. Meso- and metathorax blackish. Legs dark brown, femora with a light transverse band near the tip, especially pronounced in the hind femora; first tarsal segment long, about as long as two and three together, second tarsal segment a little shorter than the third. Wings with heavy brown veins; infuscated along the costal margin between costa and radius, a transverse band at the cord and a lighter band beyond the cord; anal area of hind wings large. Abdomen yellowish brown except the tip, which is darkly chitinized (8, 9 and 10 in the male, and 9 and 10 in the female).

Genitalia: *Male.* Subanal lobes small, rounded behind and unmodified. Supraanal process recurved over the abdomen, heavily chitinized underneath, broad at the base and tapering to a slender point, cleft in the middle with a membrane on top and two rearward pointing spines behind. Cerci each composed of one chitinized segment. Subgenital plate short, pointed and without ventral lobe at the base, tenth tergite depressed in the middle, with a raised knob on each side.

Female. Seventh sternite produced posteriorly over eighth sternite which is unmodified; genital opening not guarded by distinct valves.

Holotype, male; *allotype,* female; June 12-22, 1901, Adirondack Mts., Axton, N.Y., A. D. McGillivray and C. O. Houghton, Cornell University Collection.

Paratypes: 2 females, same locality; one female, Old Forge, N. Y., June 26, 1905; one female, Tim Pond Plantation, Maine, 6-22.

Explanation of Plate xiii.

Fig. 1. *Leuctra bradleyi* sp. nov. male.
Fig. 2. *Leuctra biloba* sp. nov. male.
Fig. 3. *Leuctra biloba* sp. nov. female.
Fig. 4. *Leuctra carolinensis* sp. nov. male.
Fig. 5. *Leuctra carolinensis* sp. nov. female.
Fig. 6. *Leuctra duplicata* sp. nov. male.
Fig. 7. *Leuctra duplicata* sp. nov. female.
Fig. 8. *Leuctra decepta* sp. nov. male.
Fig. 9. *Leuctra decepta* sp. nov. female.
Fig. 10. *Leuctra glabra* sp. nov. male.

Fig. 11 *Leuctra hamula* sp. nov. female.
Fig. 12. *Leuctra hamula* sp. nov. male.
Fig. 13. *Leuctra infuscata* sp. nov. male.
Fig. 14. *Leuctra infuscata* sp. nov. female.
Fig. 15. *Leuctra sibleyi* sp. nov. male.
Fig. 16. *Leuctra sibleyi* sp. nov female.
Fig. 17. *Leuctra truncata* sp. nov. male.
Fig. 18. *Leuctra truncata* sp. nov. female.
Fig. 19. *Leuctra triloba* sp. nov. male.
Fig. 20 *Leuctra triloba* sp. nov. female.
Fig. 21. *Nemoura punctipennis* sp. nov. female.
Fig. 22. *Nemoura punctipennis* sp. nov. male.

Explanation of Plate xiv.

Fig. 1. *Nemoura glabra* sp. nov. male.
Fig. 2. *Nemoura glabra* sp. nov. female.
Fig. 3. *Nemoura divergens* sp. nov. male.
Fig. 4. *Nemoura biloba* sp. nov. male.
Fig. 5. *Nemoura biloba* sp. nov. female.
Fig. 6. *Nemoura bifurcata* sp. nov. male.
Fig. 7. *Nemoura californica* sp. nov. male.
Fig. 8. *Nemoura californica* sp. nov. female.
Fig. 9. *Nemoura flexura* sp. nov. male.
Fig. 10. *Nemoura flexura* sp. nov. female.
Fig. 11. *Nemoura cornuta* sp. nov. male.
Fig. 12. *Nemoura frigida* sp. nov. male.
Fig. 13. *Nemoura delicatula* sp. nov. male.
Fig. 14. *Nemoura delicatula* sp. nov. female.
Fig. 15. *Nemoura columbiana* sp. nov. male.
Fig. 16. *Nemoura producta* sp. nov. male.
Fig. 17. *Nemoura producta* sp. nov. female.
Fig. 18. *Nemoura nevadensis* sp. nov. male.
Fig. 19. *Nemoura nevadensis* sp. nov. female.
Fig. 20. *Nemoura washingtoni* sp. nov. male.
Fig. 21. *Nemoura washingtoni* sp. nov. female.
Fig. 22. *Nemoura carolinensis* sp. nov. male.
Fig. 23. *Nemoura interrupta* sp. nov. male.
Fig. 24. *Nemoura oregonensis* sp. nov. male.
Fig. 25. *Nemoura trispinosa* sp. nov. male.
Fig. 26. *Nemoura trispinosa* sp. nov. female.
Fig. 27. *Nemoura serrata* sp. nov. male.
Fig. 28. *Nemoura prolongata* sp. nov. male.
Fig. 29. *Nemoura prolongata* sp. nov. female.
Fig. 30. *Nemoura rotunda* sp. nov. female.
Fig. 31. *Nemoura rotunda* sp. nov. male.
Fig. 32. *Nemoura truncata* sp. nov. male.

DIAMOND JUBILEE MEETING

OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1923.

The Diamond Jubilee Meeting of the Entomological Society of Ontario was held in Ottawa on Thursday, Friday and Saturday, November 1st, 2nd, and 3rd.

The morning and afternoon meetings were held in the exhibition room of the Dominion Entomological Branch. The Thursday evening meeting was held in the assembly hall of the Normal school, when Dr. A. F. Burgess delivered the public address on "The Value of Natural Enemies of Injurious Insects." On Friday evening the members and visitors met at dinner in the University Club. After dinner the gathering was addressed by Mr. J. A. Ruddick of the Dominion Department of Agriculture and Mr. Morris delivered the presidential address: "Nature's Clairvoyant; A Study of W. H. Hudson." A short paper from Dr. Bethune entitled "The Early Days of the Entomological Society of Ontario" was read by Mr. Gibson. An interesting feature of the meeting was the visit to the Parliament Buildings and Central Experimental Farm on Saturday morning. During the meeting motion picture films entitled "Where the Moose Runs Loose," "A New Yorker's Canadian Week-End," and "The European Corn Borer," were shown through the kindness of the National Parks Branch, Dept. of Interior, the Motion Picture Branch, Dept. of Trade and Commerce and the Provincial Motion Picture Bureau.

The meetings were very well attended by members of the society and visitors and were highly successful. Much credit must be given to the local committee in charge for the splendid arrangements made for the convenience and entertainment of visiting members.

During the meetings the following papers were presented:

1. Notes on the Rose Curculio in Manitoba—Mr. H. A. Robertson.
2. The Control of the Apple Sucker (*Psyllia mali* Schmid.) in Nova Scotia by *Entomophthora sphaerosperma* Fres.—Mr. A. G. Dustan.
3. Concerning the Canadian Species of the Syrphid Genus *Eumerus* (Diptera) —Mr. C. Howard Curran.
4. The Occurrence of the Ptinid Beetle, *Niptus hololeucus* in North America. —Mr. Arthur Gibson.
5. Transfer Tests with the Green Apple Aphids (*Aphis pomi* DeGeer; *Aphis spiraecola* Patch)—Edith M. Patch (read by Mr. W. A. Ross).
6. The Distribution of Canadian Odonata.—Mr. E. M. Walker.
7. Two Problems in Natural Control.—Mr. Norman Criddle.
8. The Present Status and Distribution of the Apple and Thorn Skeletonizer, *Hemerophila pariana*.—Dr. M. Leonard.
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14. The Onion Maggot and Its Control.—Messrs. H. E. Gray, G. H. Hammond and T. Armstrong.
15. The Garden Springtail (*Sminthurus hortensis*) as a Crop Pest.—Dr. W. H. Brittain.
16. Notes on the Life History of *Hypera punctata*.—Messrs. H. F. Hudson and A. A. Wood.
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18. Will the Gypsy Moth Cross the International Boundary —Mr. H. L. McIntyre.
19. Canadian Problems in Forest Entomology.—Dr. J. M. Swaine.
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27. The Present Status and Spread of the Japanese Beetle.—Dr. C. H. Hadley.
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29. A Study of the Pupal Case of *Prionoxystus macmurtrei*.—Mr. C. B. Hutchings.
30. Methods in Insect Photography.—Prof. A. Brooker Klugh.
31. Notes on the Injury Caused by *Monochamus scutellatus* to Burned Standing Timber in New Brunswick.—Dr. J. Tothill.

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